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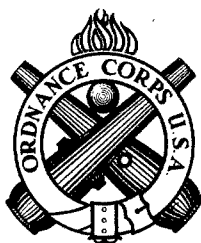
D I G I T A L C O M P U T E R P R O G R A M
F O R
W H E E L E D V E H I C L E M O B I L I T Y C O M P U T A T I O N

by
Alexander Edwards

January 1960

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Contract No. DA-20-089-ORD-39246

Project No. 5510.11.270

D/A Project No. 5W72-01-001

Reviewed Bred Radko

Approved SA Sullivan

Ordnance Tank-Automotive Command
Detroit Arsenal
Center Line, Michigan

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SNL Keller

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ABSTRACT

A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.

Curves of sinkage and drawbar pull versus mud and snow soil consistency values were plotted of various sized tires for preliminary design guidance.

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PROJECT TITLE: DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE COMPUTATION

INTRODUCTION:

The Land Locomotion Laboratory of the Ordnance Tank-Automotive Command has established the essential parameters governing wheeled vehicle mobility on soft soil terrain, resulting in a definitive method of calculating mobility performance.

Determination of vehicle mobility is now possible by application of the Land Locomotion Laboratory research, but the solution is lengthy and the procedure complex.

This report presents a high-speed computation method programmed for a digital computer system possessing 4,000 words of drum storage, 800,000 words of magnetic tape storage, floating point procedure, and flexowriter printout.

OBJECT:

Provide a general computer program for calculating wheeled vehicle mobility using the Electrodata 204 Digital Computer; describe vehicle mobility in terms of drawbar pull, depth of sinkage, and soil parameters for various terrain conditions.

SUMMARY:

The computer program outlined in this report for computing wheeled vehicle mobility is based on the theory and method described by M. G. Bekker in "Theory of Land Locomotion."

The factors essential to the program are represented by the following expressions and relationships:

Drawbar Pull	$DP = H - R_c$
Tractive Effort	$H = blc + W \tan \phi$
Compaction Resistance	$R_c = \frac{bkz^{n+1}}{n+1}$
Length of Ground Contact Area	$L = 2 \sqrt{z(D-z)}$
Sinkage	$z = \left[\frac{3W}{bk(3-n) \sqrt{D}} \right] \frac{2}{2n+1}$
Soil Factor	$k = \frac{k_c}{b} + k_\phi$

The required vehicle and soil data necessary for the evaluation of vehicle mobility performance are as follows:

b = tire width, inches

D = tire diameter, inches

W = maximum load, lbs.

k_c = "cohesive" modulus of deformation

k_ϕ = "frictional" modulus of deformation

n = sinkage exponent

c = coefficient of internal soil cohesion

$\tan \phi$ = tangent of the angle of internal soil friction

Established values for k_c , k_ϕ , n , c , and $\tan \phi$ in various soil conditions are listed in Appendix A.

CONCLUSIONS AND RESULTS:

The digital computing machine procedure for computing "Wheeled Vehicle Mobility" requires approximately 1/2 man-hour of operation to complete one vehicle analysis. This results in a time saved ratio of 8 to 1 over conventional computing methods. The ratio increases to over 100 to 1 when a great number of vehicle studies are required.

Curves of sinkage and drawbar pull versus mud and snow soil factors were plotted of various sized tires in Appendix B for preliminary design guidance.

DIGITAL COMPUTER PROGRAM:

1. Program Statements Nomenclature:

$c_0 = b$	$i_1 = \text{number of sets of parameters}$
$c_1 = D$	$y_0 = k$
$c_2 = W$	$y_1 = Z$
$c_{i0} = k_c \text{'s}$	$y_2 = L$
$c(i_0 + i_1) = k_\phi \text{'s}$	$y_3 = H$

$$c(i_0 + 211) = n's$$

$$y_4 = R_c$$

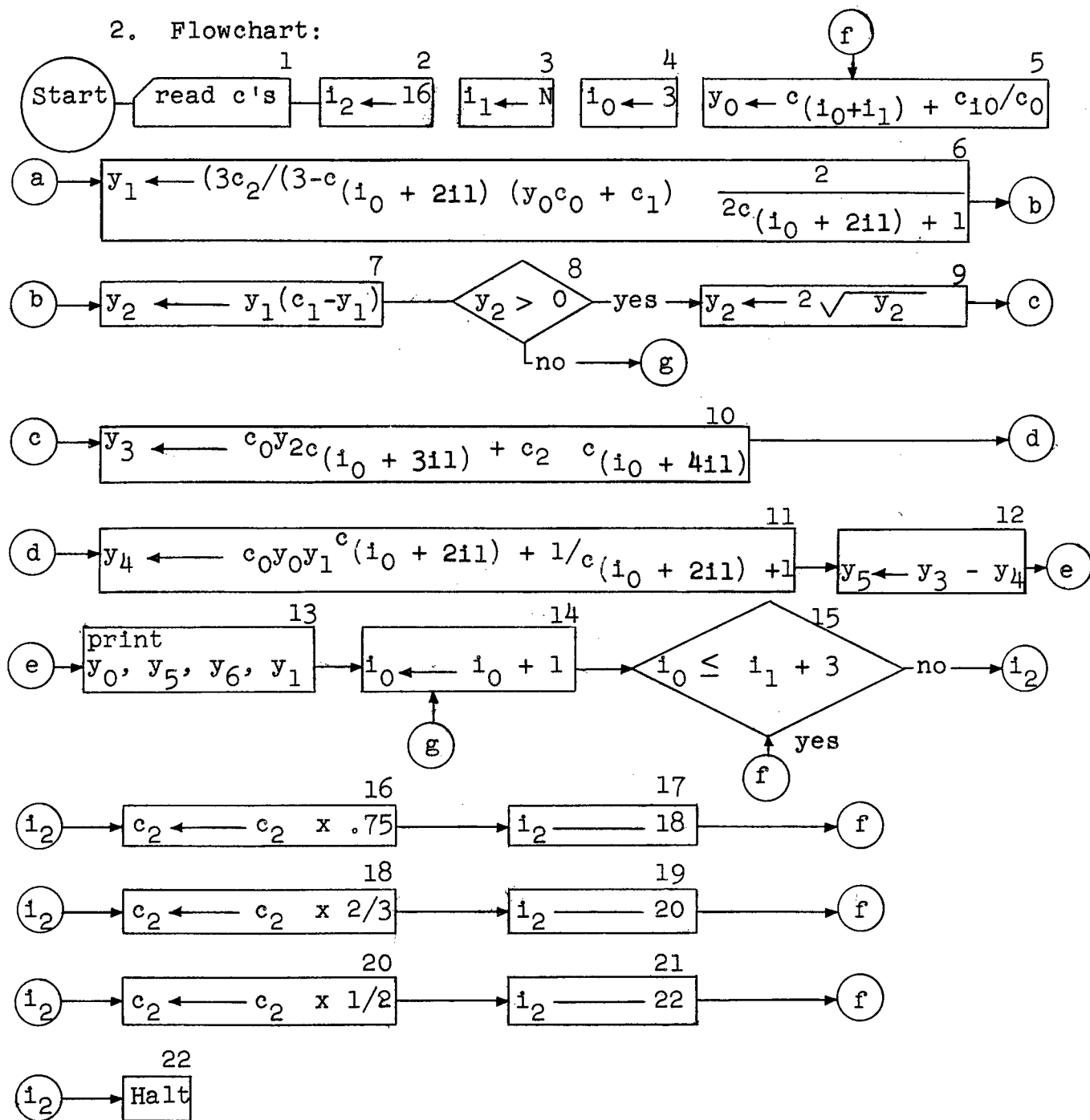
$$c(i_0 + 311) = c's$$

$$y_5 = DP$$

$$c(i_0 + 411) = \tan\phi's$$

$$y_6 = DP/W$$

2. Flowchart:



3. Input Data:

4 0000 00 0000

1 = number of sets of parameters

4 0000 00 0009

0009 b

0010 D

0011 W

k_{c1}

k_{c2}

°

°

k_{c1}

$k_{\phi 1}$

$k_{\phi 2}$

°

°

$k_{\phi 1}$

n_1

n_2

°

°

°

n_1

c_1

c_2
 \cdot
 \cdot
 \cdot
 c_1
 $(\tan \phi)_1$
 \cdot
 \cdot
 \cdot
 $(\tan \phi)_1$

6 0000 30 0120

4. Operating the Program:

1. Turn high speed tape "ON".
2. Turn magnetic tape #2 "ON" with the Compiler tape occupying #2.
3. Read in program tape.
4. Read in data tape. (Program starts automatically and punches results on high-speed punch).

5. Output:

The output is in the following form:

b	D	W	k_{c1}	k_{ϕ}	n_1	c_1	$(\tan \phi)_1$
k_1	$(DP)_1$	$(DP/W)_1$	z_1				
b	D	W	k_{c2}	$k_{\phi 2}$	n_2	c_2	$(\tan \phi)_2$
k_2	$(DP)_2$	$(DP/W)_2$	z_2				
\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot
\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot
\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot	\cdot
b	D	W	k_{c1}	$k_{\phi 1}$	n_1	c_1	$(\tan \phi)_1$
k_1	$(DP)_1$	$(DP/W)_1$	z_1				

6. Detail Printout of Compiled Program:

The following is a detail printout of the compiled program¹:

				<u>REMARKS</u>
i0	0000			base address of i0
y0	0003			base address of y
c0	0009			base address of c
s0	0070			base address of s
b0	0120			base address of b
006 e	01	3560	0562	Page turning routine
209 e	06	3440	0486	10 ^x routine
207 e	04	3360	0482	log ₁₀ x routine
200 e	04	3280	0463	square root routine
005 e	03	3220	0554	Print out routine
099 e	01	3200	0460	Fixed point error routine
f.p.a.e	18	3580	0501	Floating Point routine
0si2=14	f			Set index for parameters
0120	+	0000	64 7019	
0121	+	0000	02 0002	
1si1=3	f			Set index for parameters
0122	+	0000	64 7018	
0123	+	0000	02 0001	
2e"5e,7054,c0,c1,c2,ci1,c(i1+i0),c(i1+2xi0),c(i1+3xi0),c(i1+4xi0)				
"	f	Print out b, D, W, kc1, kØ1, n1, ci, and (tan Ø)i		
0124	+	0000	64 0000	
0125	+	0000	60 7017	
0126	+	0000	15 7028	
0127	+	3000	21 3200	
0128	+	0000	74 0001	
0129	+	2000	29 3200	
0130	+	0000	02 6002	
0131	+	0000	72 6002	
0132	-	0000	64 0009	
0133	+	0000	02 3960	

¹ See "The Purdue Compiler Handbook"

0134 + 0000 64 0000
 0135 + 0000 60 7018
 0136 + 0000 30 0140
 0137 + 0000 00 0004
 0138 + 0000 00 0003
 0139 + 0000 00 0014

REMARKS

0140 + 0000 15 7042
 0141 + 3000 21 3200
 0142 + 0000 74 0001
 0143 + 2000 29 3200
 0144 + 0000 02 6002
 0145 + 0000 72 6002
 0146 - 0000 64 0009
 0147 + 0000 02 3961
 0148 + 0000 64 0000
 0149 + 0000 60 7019
 0150 + 0000 15 7052
 0151 + 3000 21 3200
 0152 + 0000 74 0001
 0153 + 2000 29 3200
 0154 + 0000 02 6002
 0155 + 0000 72 6002
 0156 - 0000 64 0009
 0157 + 0000 02 3962
 0158 + 0000 30 0160
 0159 + 0000 00 0002

0160 + 0000 64 0000
 0161 + 0000 74 0001
 0162 + 2000 29 3200
 0163 + 0000 02 6002
 0164 + 0000 72 6002
 0165 - 0000 64 0009
 0166 + 0000 02 3963
 0167 + 0000 72 0001
 0168 - 0000 64 0009
 0169 + 0000 02 3964
 0170 + 0000 64 0011
 0171 + 0000 02 3965
 0172 + 0000 64 0010
 0173 + 0000 02 3966
 0174 + 0000 64 0009
 0175 + 0000 02 3967
 0176 + 0000 64 7019
 0177 + 0900 21 3220
 0178 + 0000 30 0180
 0179 + 0000 00 7054

$$3sy0=c(i0+i1)+ci1/c0 \quad f$$

$$k = \frac{k_c}{b} + k_\emptyset$$

0180 + 0000 64 0009
 0181 + 0000 72 0001
 0182 + 0000 02 6000
 0183 - 0000 64 0009
 0184 + 6000 21 3596
 0185 + 0000 02 6000
 0186 + 0000 64 0001
 0187 + 0000 74 0000
 0188 + 2000 29 3200
 0189 + 0000 02 6001
 0190 + 0000 72 6001
 0191 - 0000 64 0009
 0192 + 6000 21 3580
 0193 + 0000 02 0003

REMARKS

$$4sy1=((3.xc2)/((3.-c(i1+2xi0))xy0xc0x"200e,c1"))*(2./((2.xc(i1+2xi0))+1.))f$$

0194 + 0000 64 7019
 0195 + 0000 02 6002
 0196 + 0000 64 0000
 0197 + 0000 30 0200
 0198 - 0640 00 0009
 0199 + 5110 00 0000

$$z = \left[\frac{3W}{bk(3-n)D} \right] \frac{2}{2n+1}$$

0200 + 0000 60 7019
 0201 + 0000 15 7003
 0202 + 3000 21 3200
 0203 + 0000 74 0001
 0204 + 2000 29 3200
 0205 + 0000 02 6004
 0206 + 0000 72 6004
 0207 - 0000 64 0009
 0208 + 7018 21 3600
 0209 + 6002 21 3580
 0210 + 0000 02 6001
 0211 + 0000 64 7018
 0212 + 6001 21 3596
 0213 + 0000 02 6000
 0214 + 0000 64 0010
 0215 + 0100 21 3280
 0216 + 0009 21 3600
 0217 + 0000 30 0220
 0218 + 5120 00 0000
 0219 + 0000 00 0002

0220 + 0003 21 3600
 0221 + 0000 02 6002
 0222 + 0000 64 0000
 0223 + 0000 60 7019
 0224 + 0000 15 7026

REMARKS

0225 + 3000 21 3200
 0226 + 0000 74 0001
 0227 + 2000 29 3200
 0228 + 0000 02 6004
 0229 + 0000 72 6004
 0230 - 0000 64 0009
 0231 + 0000 02 6003
 0232 + 0000 64 7018
 0233 + 6003 21 3584
 0234 + 6002 21 3600
 0235 + 0000 02 6001
 0236 + 0000 64 0011
 0237 + 0000 30 0240
 0238 + 5130 00 0000
 0239 + 0000 00 0002

0240 + 7019 21 3600
 0241 + 6001 21 3596
 0242 + 0000 21 3360
 0243 + 6000 21 3600
 0244 + 0000 21 3440
 0245 + 0000 02 0004

25sy2=y1x(c1-y1) f z (D-z)

0246 + 0000 64 0004
 0247 + 0000 02 6001
 0248 + 0000 64 0010
 0249 + 6001 21 3584
 0250 + 0004 21 3600
 0251 + 0000 02 0005

26rg27,ry2/=0. f One space if $z(D-z) < 0$, if $z(D-z) > 0$,
 go to Statement 5

0252 + 0000 64 7018
 0253 + 0000 02 6000
 0254 + 0000 64 0005
 0255 + 6000 21 3584
 0256 + 0000 15 0440
 0257 + 0000 30 0260
 0258 - 0000 00 0000
 0259 + 5130 00 0000

0260 + 0000 73 7019
 0261 + 0000 28 7063
 0262 + 0000 20 0097

5sy2=2.x"200e,y2" f L = $2\sqrt{z(D-z)}$

0263 + 0000 64 0005
 0264 + 0100 21 3280

0265 + 7018 21 3600
 0266 + 0000 02 0005

REMARKS

$$6sy3=(c0xy2xc(i1+3xi0))+(c2xc(i1+4xi0))f \quad H = bLc + W \tan \emptyset$$

0267 + 0000 64 0000
 0268 + 0000 60 7017
 0269 + 0000 15 7071
 0270 + 3000 21 3200
 0271 + 0000 74 0001
 0272 + 2000 29 3200
 0273 + 0000 02 6002
 0274 + 0000 72 6002
 0275 - 0000 64 0009
 0276 + 0000 30 0280
 0277 + 0000 00 0004
 0278 + 5120 00 0000
 0279 - 0000 00 0000

0280 + 0011 21 3600
 0281 + 0000 02 6000
 0282 + 0000 64 0000
 0283 + 0000 60 7019
 0284 + 0000 15 7086
 0285 + 3000 21 3200
 0286 + 0000 74 0001
 0287 + 2000 29 3200
 0288 + 0000 02 6002
 0289 + 0000 72 6002
 0290 - 0000 64 0009
 0291 + 0005 21 3600
 0292 + 0009 21 3600
 0293 + 6000 21 3580
 0294 + 0000 02 0006

$$7sy4=c0xy0x(y1*(c(i1+2xi0)+1.)))/(c(i1+2xi0)+1.)f \quad R_c = \frac{bk \, z^{n+1}}{n+1}$$

0295 + 0000 64 7018
 0296 + 0000 02 6001
 0297 + 0000 30 0300
 0298 + 5110 00 0000
 0299 + 0000 00 0003

0300 + 0000 64 0000
 0301 + 0000 60 7019
 0302 + 0000 15 7004
 0303 + 3000 21 3200
 0304 + 0000 74 0001
 0305 + 2000 29 3200
 0306 + 0000 02 6002
 0307 + 0000 72 6002

REMARKS

0308 - 0000 64 0009
 0309 + 6001 21 3580
 0310 + 0000 02 6000
 0311 + 0000 64 7018
 0312 + 0000 02 6002
 0313 + 0000 64 0000
 0314 + 0000 60 7019
 0315 + 0000 15 0442
 0316 + 3000 21 3200
 0317 + 0000 30 0320
 0318 + 5110 00 0000
 0319 + 0000 00 0002

0320 + 0000 74 0001
 0321 + 2000 29 3200
 0322 + 0000 02 6003
 0323 + 0000 72 6003
 0324 - 0000 64 0009
 0325 + 6002 21 3580
 0326 + 0000 02 6001
 0327 + 0000 64 0004
 0328 + 0000 21 3360
 0329 + 6001 21 3600
 0330 + 0000 21 3440
 0331 + 6000 21 3596
 0332 + 0003 21 3600
 0333 + 0009 21 3600
 0334 + 0000 02 0007

$$8sy3=y3-y4 \quad f$$

$$DP = H - R_c$$

0335 + 0000 64 0007
 0336 + 0000 02 6000
 0337 + 0000 64 0006
 0338 + 6000 21 3584
 0339 + 0000 30 0340

0340 + 0000 02 0006

$$9sy5=y3/c2 \quad f$$

$$DP/W = \frac{H - R_c}{W}$$

0341 + 0000 64 0011
 0342 + 0000 02 6000
 0343 + 0000 64 0006
 0344 + 6000 21 3596
 0345 + 0000 02 0008

$$10e''5e,7054,y0,y3,y5,y1''f$$

Print out k, DP, DP/W, z

0346 + 0000 64 0004
 0347 + 0000 02 3960

0348 + 0000 64 0008
 0349 + 0000 02 3961
 0350 + 0000 64 0006
 0351 + 0000 02 3962
 0352 + 0000 64 0003
 0353 + 0000 02 3963
 0354 + 0000 64 7019
 0355 + 0500 21 3220

REMARKS

11si1=i1+1 f

index j

0356 + 0000 64 7018
 0357 + 0000 30 0360
 0358 + 0000 00 0001
 0359 + 0000 00 7054

0360 + 0000 74 0001
 0361 + 2000 29 3200
 0362 + 0000 02 0001

12rg2,ri1/(i0+3) f Go to statement 2 if $j < 1 + 3$, if
 not go to Statement 13

0363 + 0000 64 7019
 0364 + 0000 74 0000
 0365 + 2000 29 3200
 0366 + 0000 02 6000
 0367 + 0000 64 0001
 0368 + 0000 75 6000
 0369 + 1000 29 3200
 0370 + 0000 15 7074
 0371 + 0000 73 7018
 0372 + 0000 28 7074
 0373 + 0000 20 0072

13gi2 f Go to change of W value

0374 + 0000 72 0002
 0375 - 0000 20 0070
 0376 + 0000 30 0380
 0377 + 0000 30 0360
 0378 - 0000 00 0000
 0379 + 0000 00 0003

14sc2=c2x.75 f Set W = .75 W

0380 + 0000 64 7019
 0381 + 0011 21 3600
 0382 + 0000 02 0011

15si2=17 f Set Switch

	<u>REMARKS</u>
0383 + 0000 64 7018	
0384 + 0000 02 0002	
0e"6e,2" f	Two spaces
0385 + 0000 64 7017	
0386 + 0100 21 3560	
16g1f	Go to statement 1 for next calculation
0387 + 0000 20 0071	
17si2=20 f	Set switch for next W
0388 + 0000 64 7016	
0389 + 0000 02 0002	
18sc2=c2x2./3.f	Set .75W to .5W
0390 + 0000 64 7015	
0391 + 0000 02 6000	
0392 + 0000 64 7014	
0393 + 0000 30 0400	
0394 + 5120 00 0000	
0395 + 5130 00 0000	
0396 + 0000 00 0020	
0397 + 0000 00 0002	
0398 + 0000 00 0017	
0399 + 5075 00 0000	
0400 + 6000 21 3596	
0401 + 0011 21 3600	
0402 + 0000 02 0011	
0e"6e,2" f	Two spaces
0403 + 0000 64 7019	
0404 + 0100 21 3560	
19g1f	Go to statement 1 for next calculation
0405 + 0000 20 0071	
20sc2=c2x.5 f	Set .5W to .25W
0406 + 0000 64 7018	
0407 + 0011 21 3600	
0408 + 0000 02 0011	
0e"6e,2" f	Two spaces

		<u>REMARKS</u>
0409	+ 0000 64 7019	
0410	+ 0100 21 3560	
21s12=23 f		Set switch
0411	+ 0000 64 7017	
0412	+ 0000 02 0002	
22g1f		Go to Statement 1 for next calculation
0413	+ 0000 20 0071	
23e"6e,3"f		Three spaces
0414	+ 0000 64 7016	
0415	+ 0000 30 0420	
0416	+ 0000 00 0003	
0417	+ 0000 00 0023	
0418	+ 5050 00 0000	
0419	+ 0000 00 0002	
0420	+ 0100 21 3560	
24h f		Stop Computing
0421	+ 0000 08 0000	
27e"6e,1"f		Turn page one time (indicating negative sinkage)
0422	+ 0000 64 7019	
0423	+ 0100 21 3560	
28g11 f		Go to next calculation
0424	+ 0000 20 0081	
0425	+ 0000 00 0000	
0426	+ 0000 00 0000	
0427	+ 0000 00 0000	
0428	+ 0000 00 0000	
0429	+ 0000 00 0000	
0430	+ 0000 00 0000	
0431	+ 0000 00 0000	
0432	+ 0000 00 0000	
0433	+ 0000 00 0000	
0434	+ 0000 00 0000	
0435	+ 0000 00 0000	
0436	+ 0000 00 0000	
0437	+ 0000 00 0000	
0438	+ 0000 00 0000	
0439	+ 0000 00 0001	

block dict

REMARKS


0440 + 0000 37 0260
0441 + 0000 20 7062
0442 + 0000 30 0320

BACKGROUND INFORMATION:


The approach presented in this computer program considers the pneumatic tire of wheeled vehicles to be rigid and provides conservative results for most soil conditions.

For more information see Mobility Studies by M. G. Bekker, W. L. Harrison, Capt. R. A. Liston and Capt. L. S. Lodewick.


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APPENDIX A

ESTABLISHED SOIL VALUES FOR
MUD (MICHIGAN SANDY LOAM) AND SNOW

APPENDIX A

ESTABLISHED SOIL VALUES FOR MUD (MICHIGAN SANDY LOAM) AND SNOW

Soil #1 Moisture 14%	Soil #2 Moisture 16%	Soil #3 Moisture 18%	Soil #4 Moisture 20%	Soil #5 Moisture 22%	Soil #6 Moisture 24%
$k_c = 17.5$	$k_c = 9.5$	$k_c = 6.5$	$k_c = 4.5$	$k_c = 3.3$	$k_c = 2.2$
$k_\phi = 6.6$	$k_\phi = 5.6$	$k_\phi = 4.7$	$k_\phi = 3.75$	$k_\phi = 2.8$	$k_\phi = 1.8$
$n = .53$	$n = .50$	$n = .47$	$n = .425$	$n = .39$	$n = .35$
$c = 1.6$	$c = 1.9$	$c = 2.05$	$c = 1.58$	$c = 1.05$	$c = .82$
$\tan\phi = .56$	$\tan\phi = .52$	$\tan\phi = .476$	$\tan\phi = .435$	$\tan\phi = .394$	$\tan\phi = .358$

SNOW

k_c	=	3.6
k_ϕ	=	.3
n	=	1.02
c	=	.18
$\tan \phi$	=	.3288

APPENDIX B

CURVES OF DRAWBAR PULL AND SINKAGE
VERSUS SOIL CONSISTENCY AND SNOW
CONSISTENCY VALUES

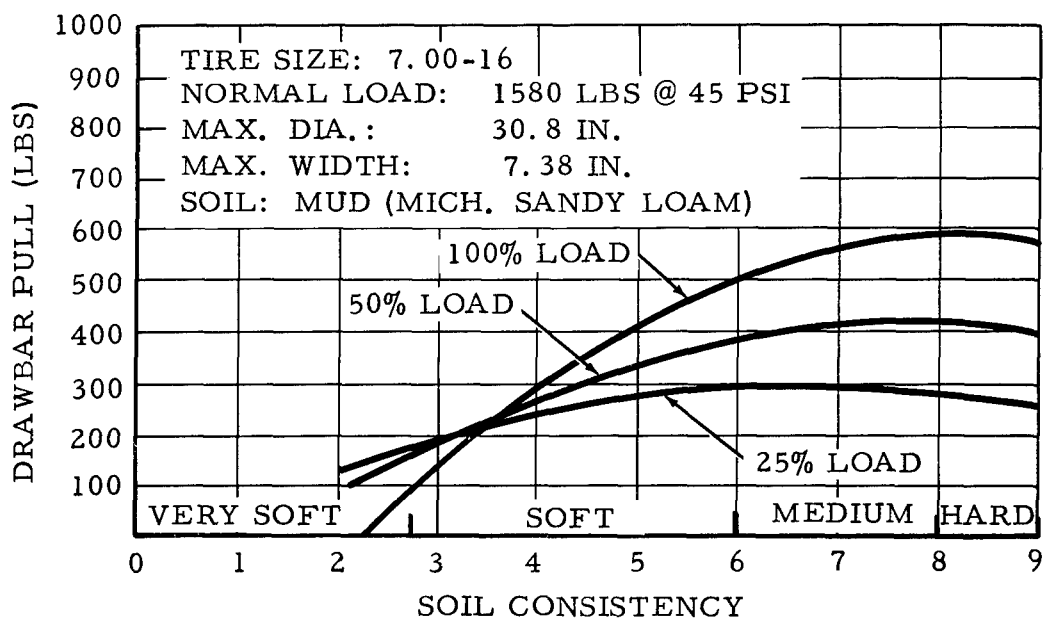


FIGURE B1. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.00-16 TIRE

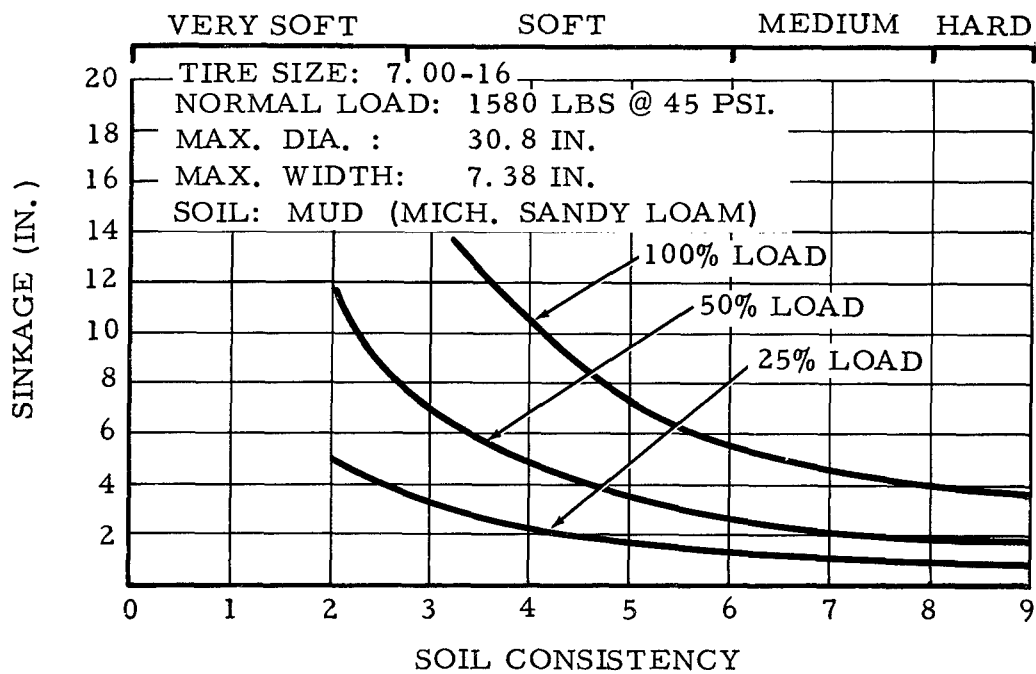


FIGURE B2. SINKAGE VS. SOIL CONSISTENCY, 7.00-16 TIRE

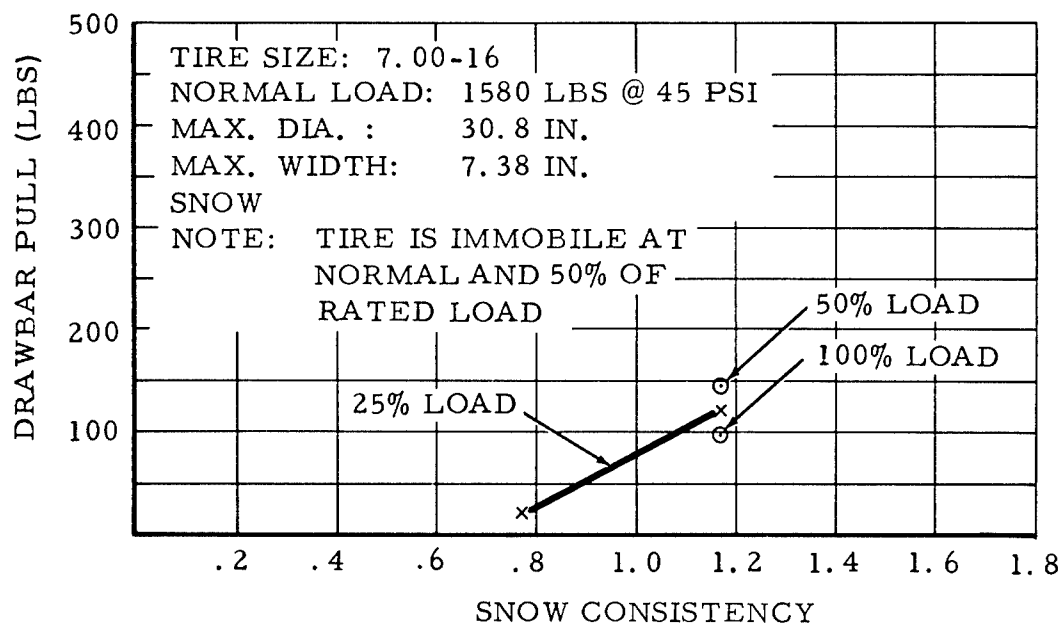


FIGURE B3. DRAWBAR PULL VS SNOW CONSISTENCY,
 7.00-16 TIRE

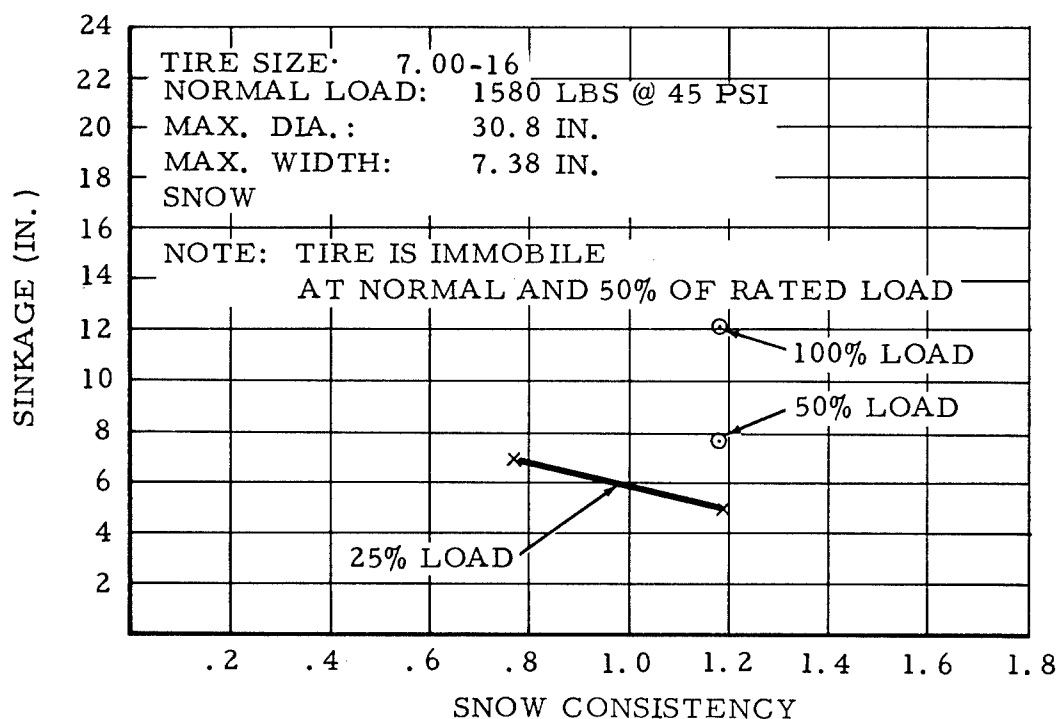


FIGURE B4. SINKAGE VS. SNOW CONSISTENCY,
 7.00-16 TIRE

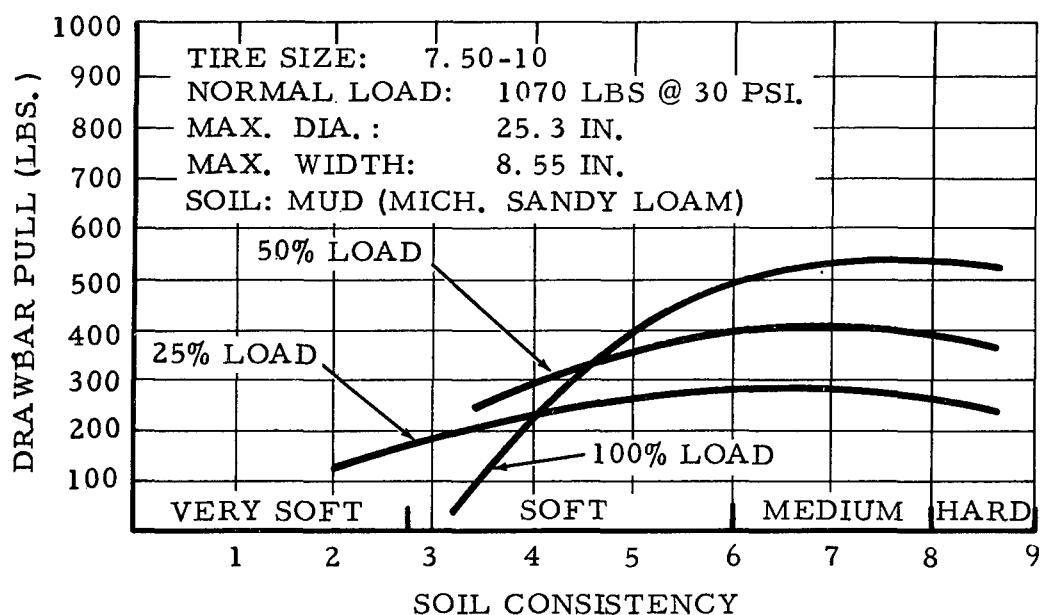


FIGURE B5. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.50-10 TIRE

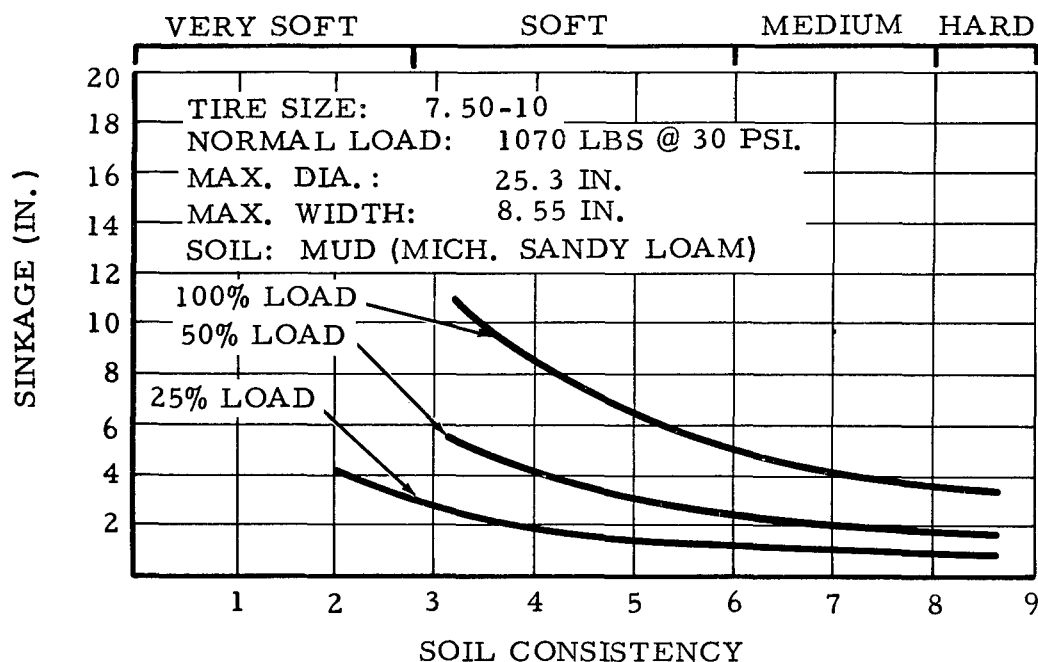


FIGURE B6. SINKAGE VS. SOIL CONSISTENCY, 7.50-10 TIRE

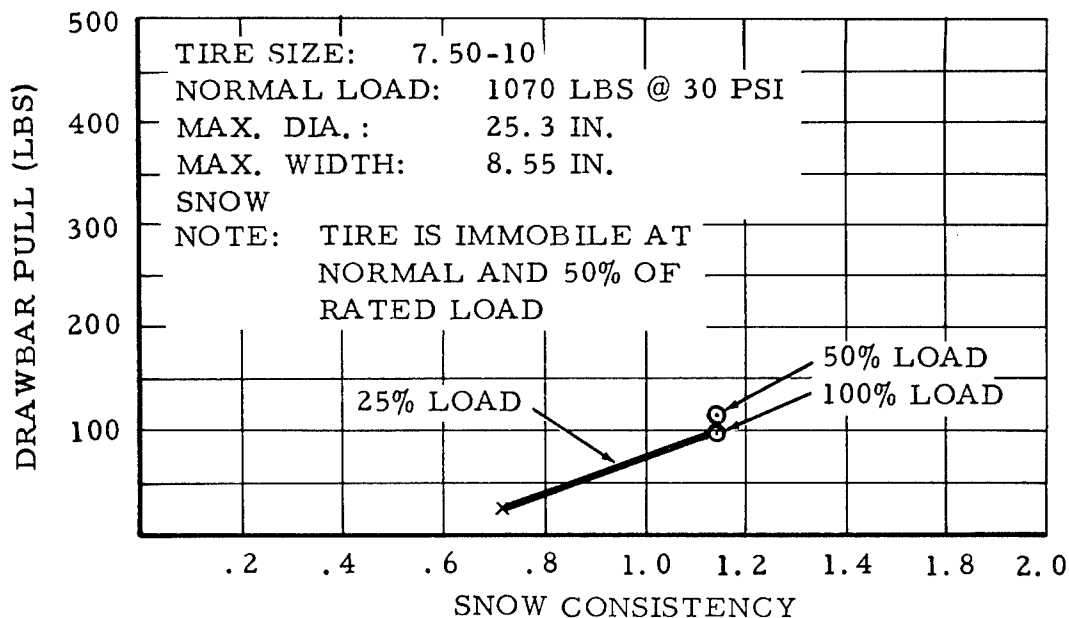


FIGURE B7. DRAWBAR PULL VS. SNOW CONSISTENCY,
 7.50-10 TIRE

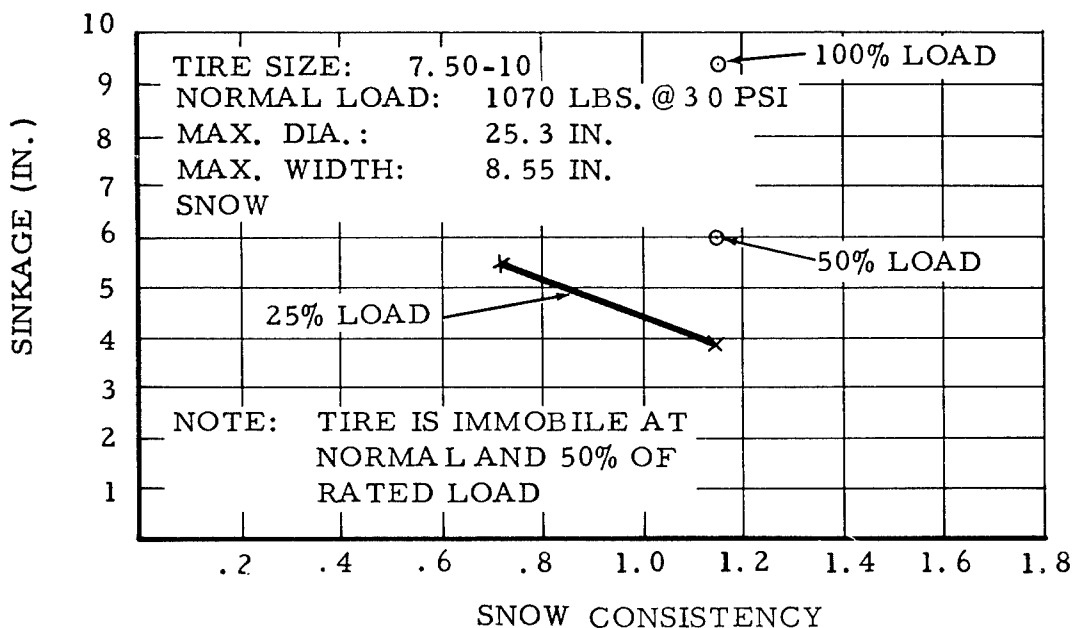


FIGURE B8. SINKAGE VS. SNOW CONSISTENCY,
 7.50-10 TIRE

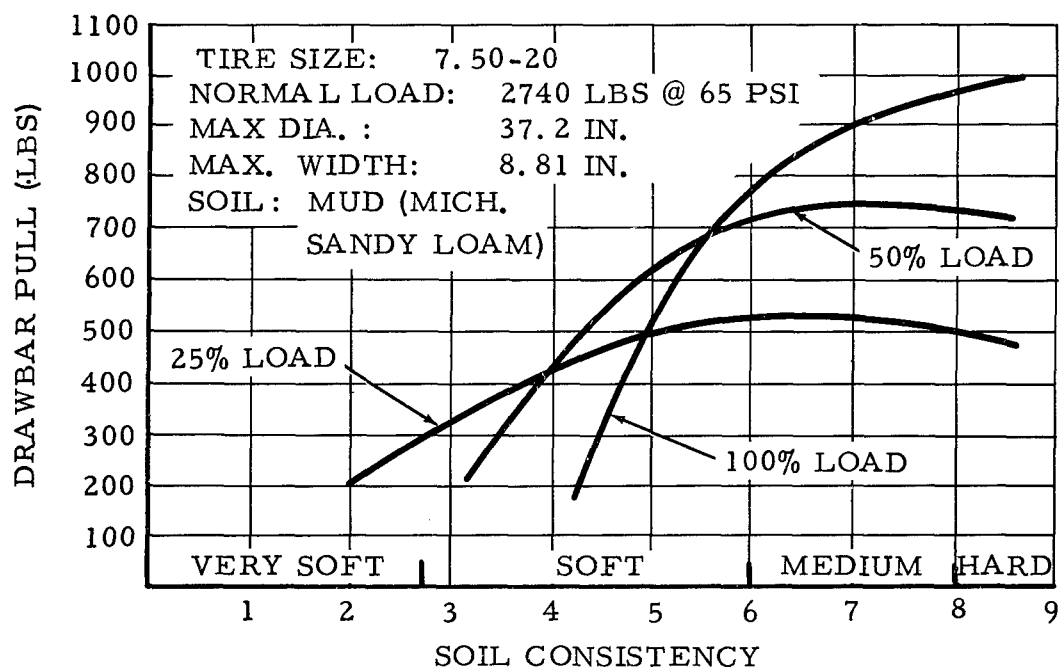


FIGURE B9. DRAWBAR PULL VS. SOIL CONSISTENCY, 7.50-20 TIRE

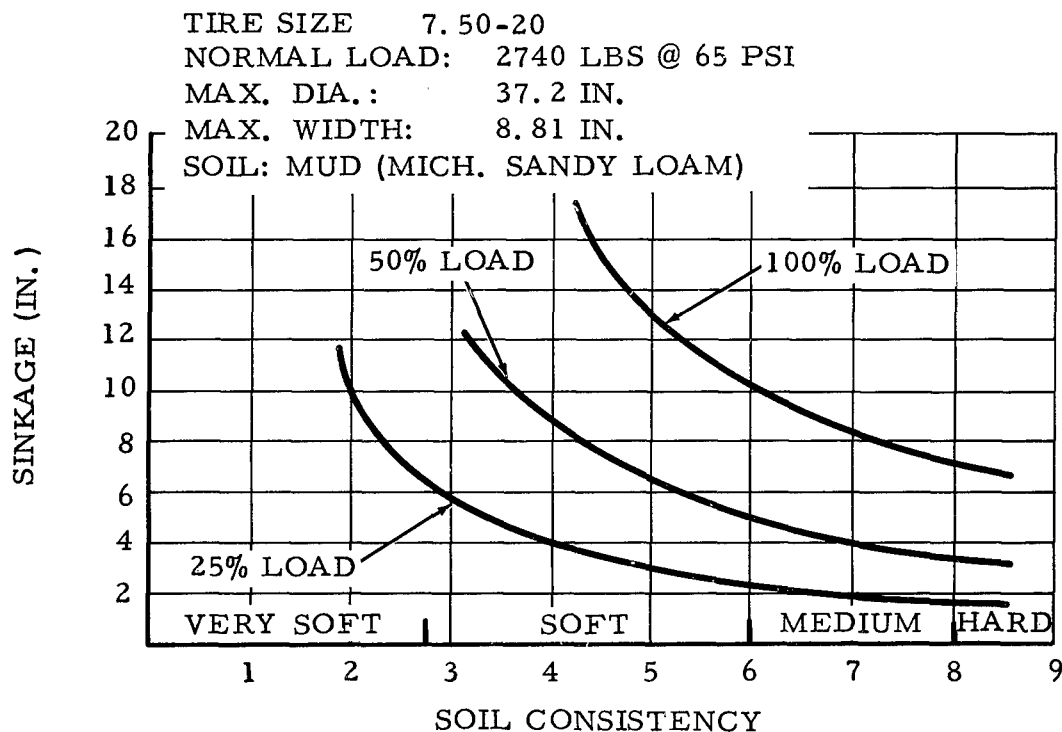


FIGURE B10. SINKAGE VS. SOIL CONSISTENCY, 7.50-20 TIRE

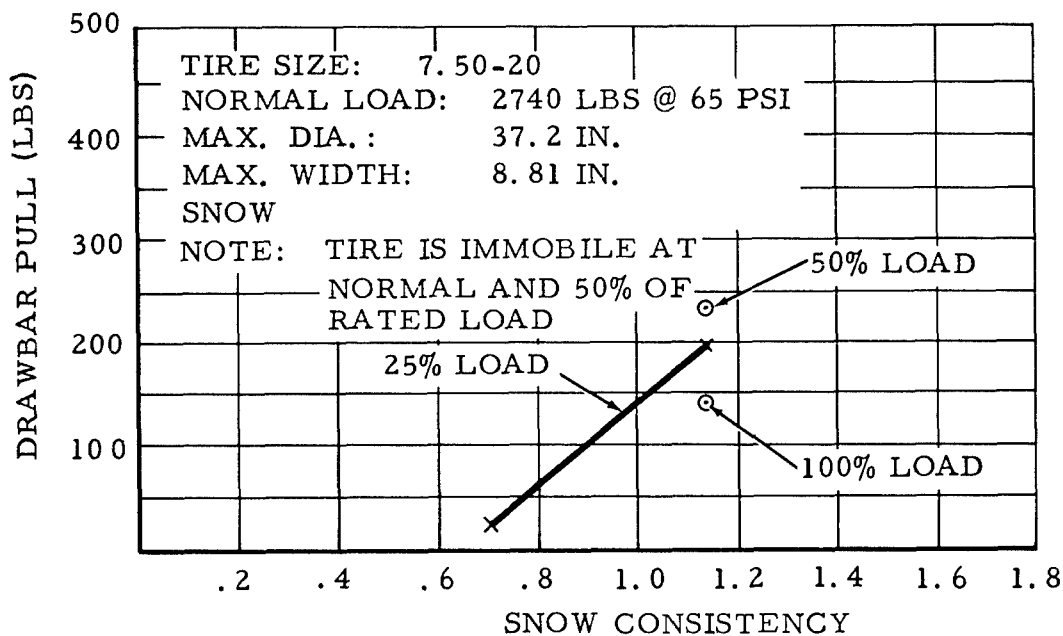


FIGURE B11. DRAWBAR PULL VS. SNOW CONSISTENCY, 7.50-20 TIRE

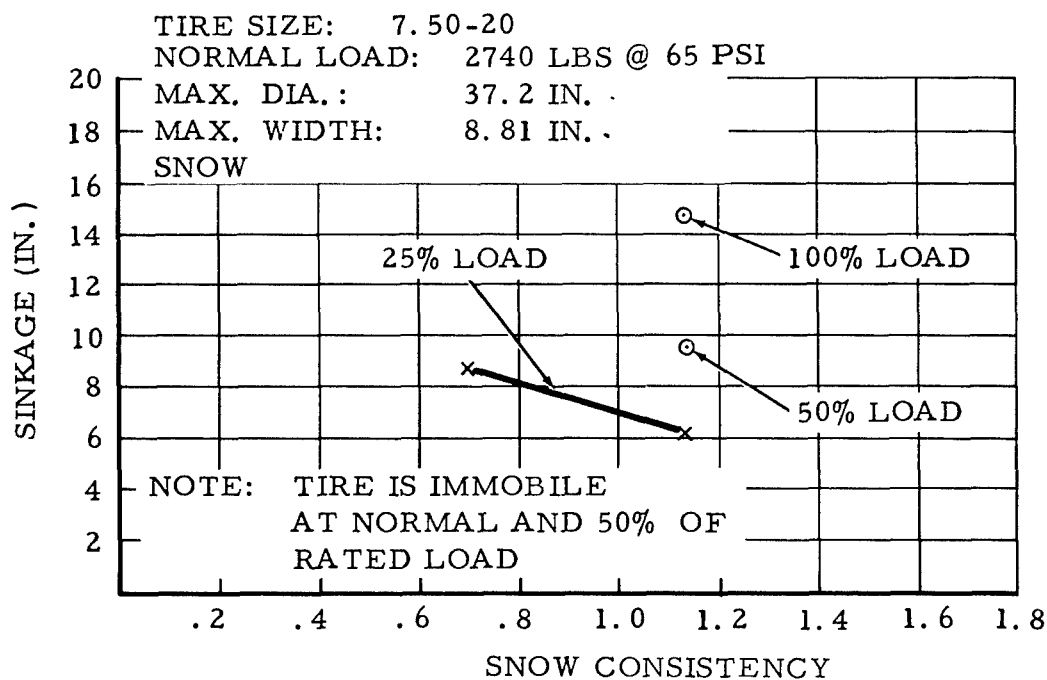


FIGURE B12. SINKAGE VS. SNOW CONSISTENCY, 7.50-20 TIRE

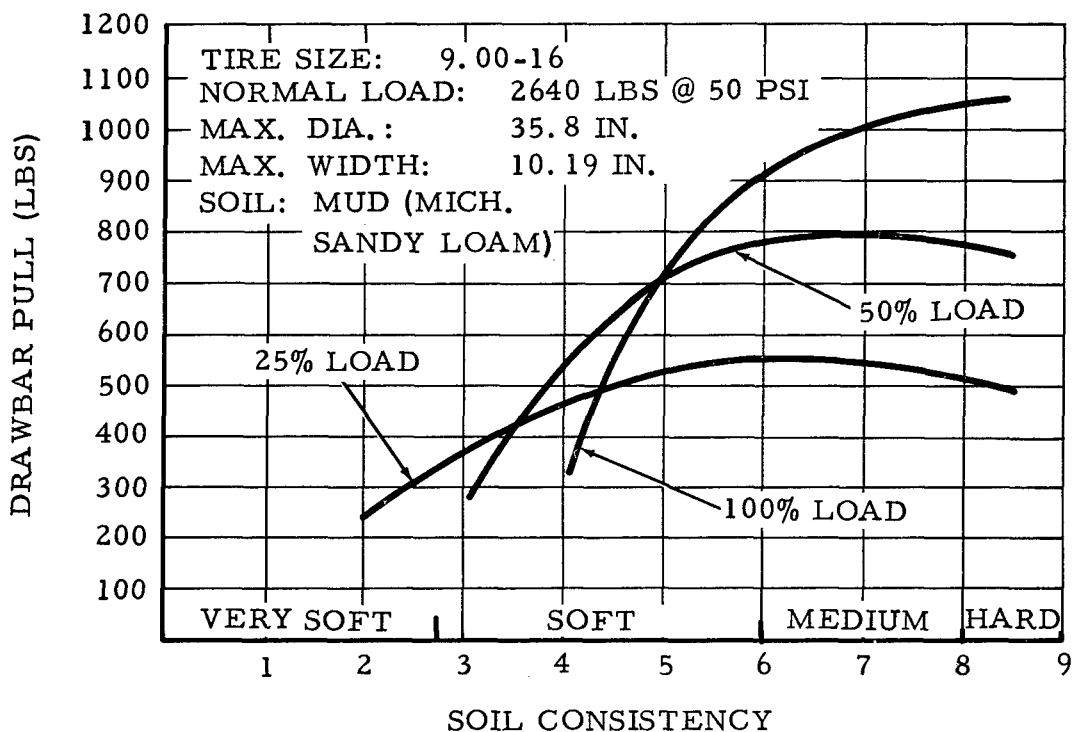


FIGURE B13. DRAWBAR PULL VS. SOIL CONSISTENCY, 9.00-16 TIRE

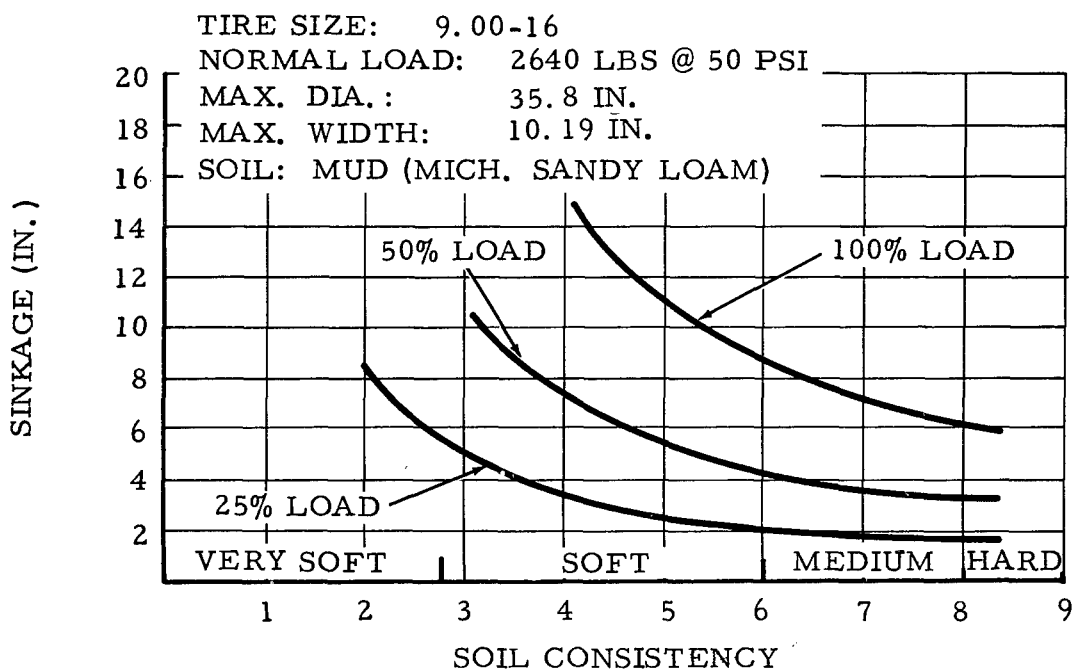


FIGURE B14. SINKAGE VS. SOIL CONSISTENCY, 9.00-16 TIRE

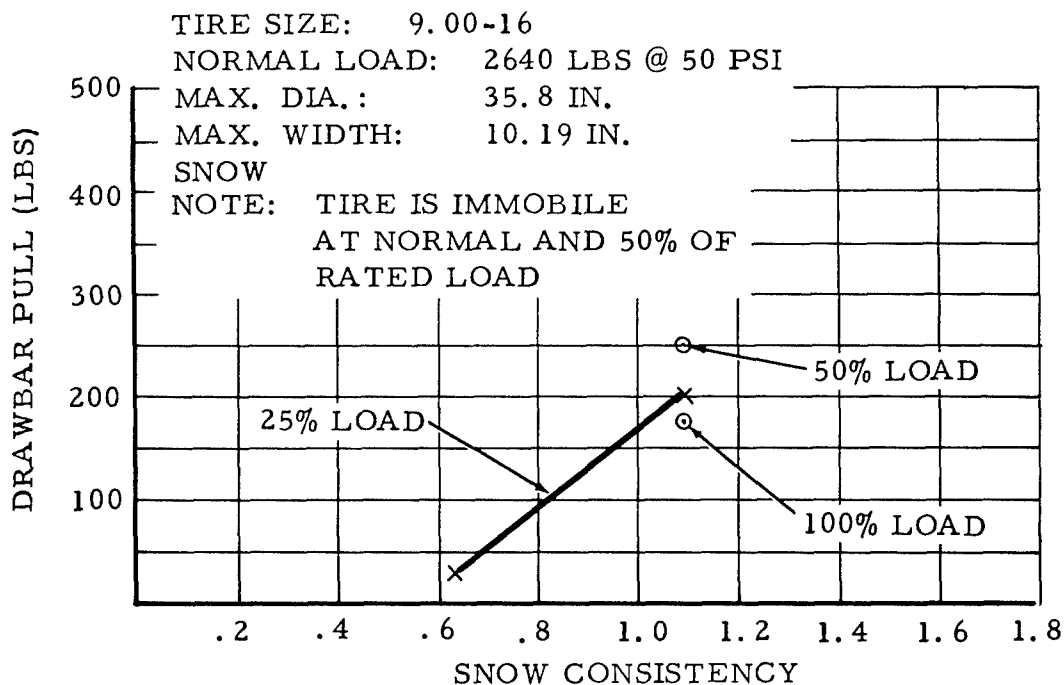


FIGURE B15. DRAWBAR PULL VS. SNOW CONSISTENCY,
 9.00-16 TIRE

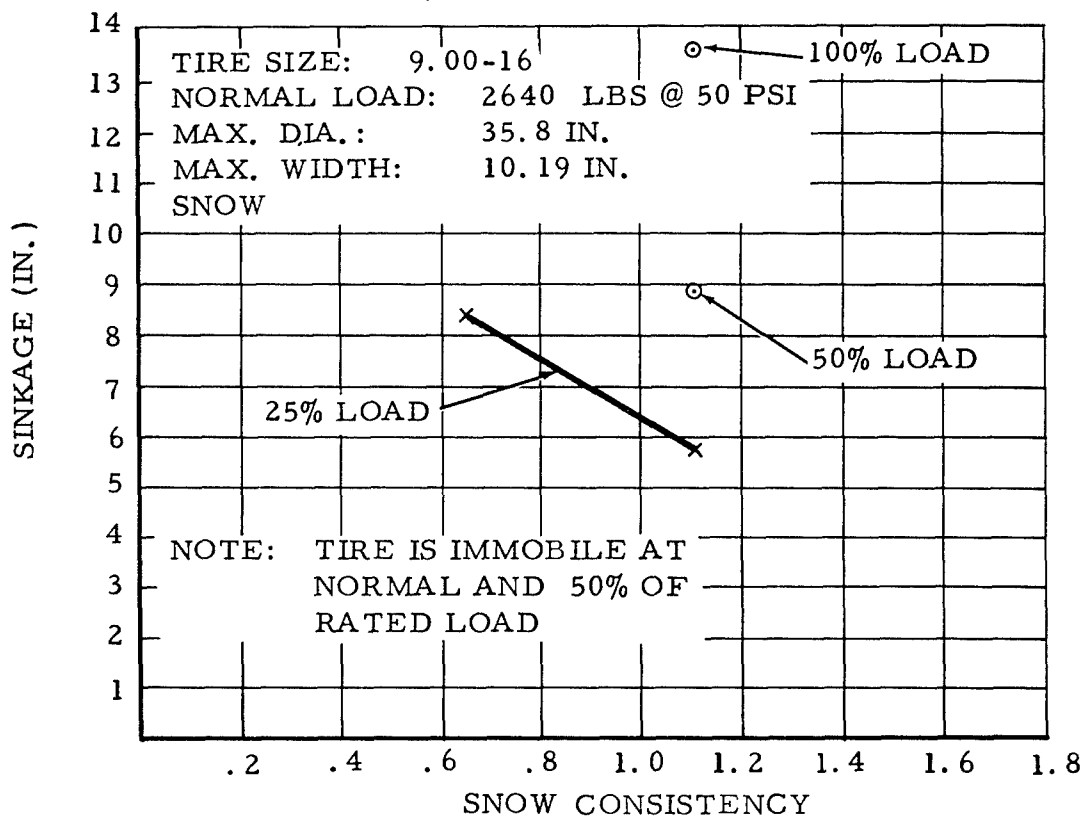


FIGURE B16. SINKAGE VS. SNOW CONSISTENCY,
 9.00-16 TIRE

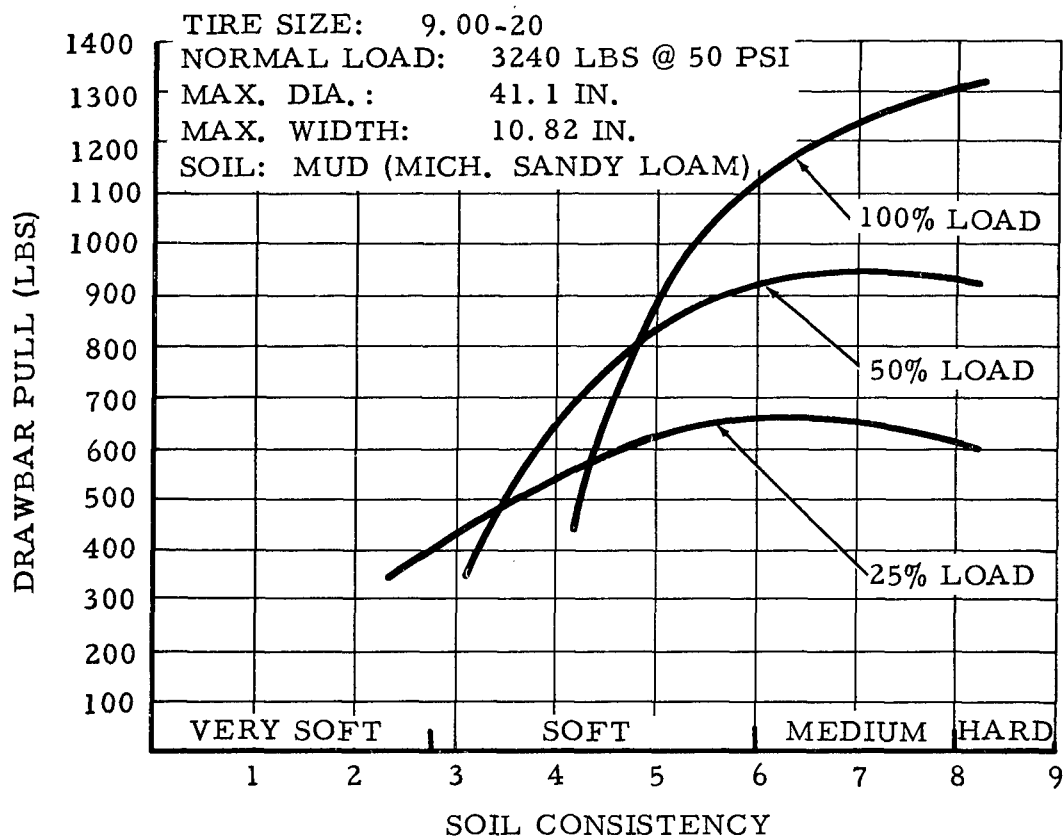


FIGURE B17. DRAWBAR PULL VS. SOIL CONSISTENCY, 9.00-20 TIRE

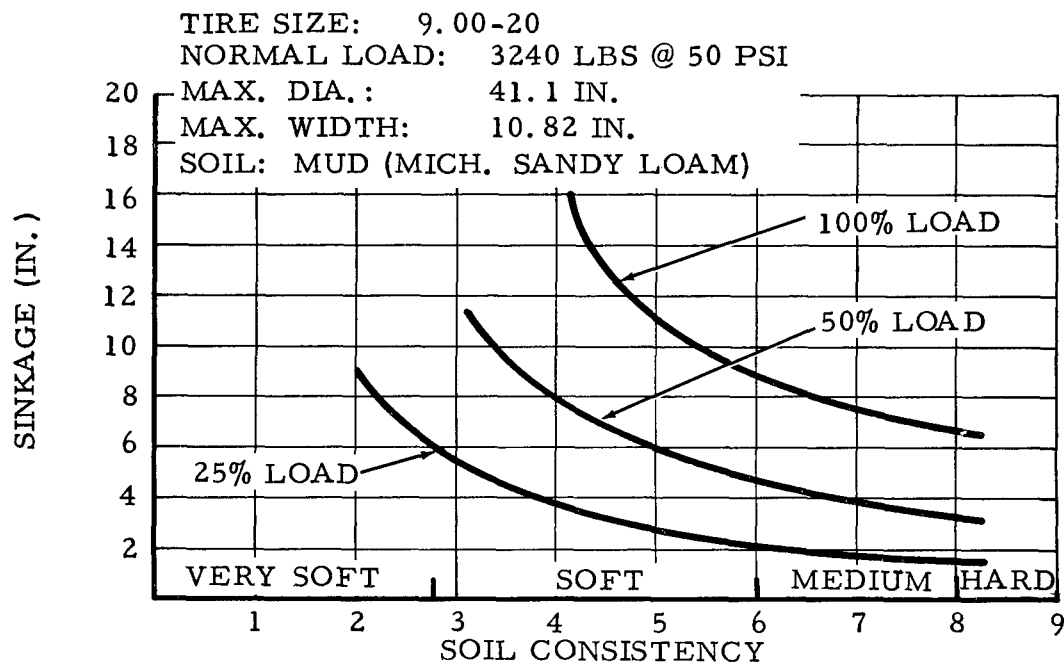


FIGURE B18. SINKAGE VS. SOIL CONSISTENCY, 9.00-20 TIRE

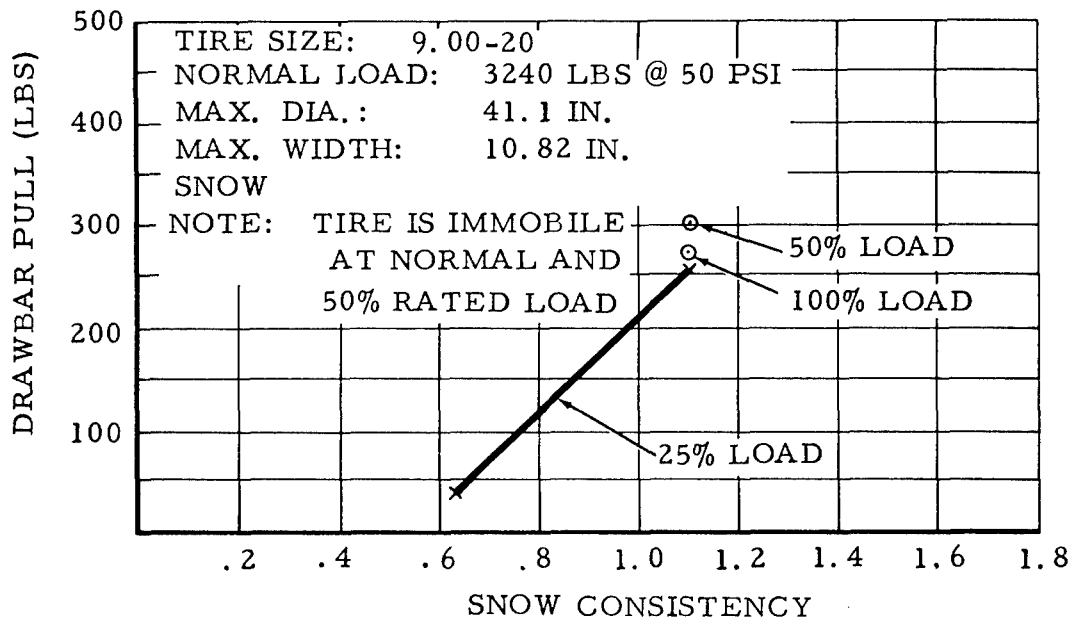


FIGURE B19. DRAWBAR PULL VS. SNOW CONSISTENCY, 9.00-20 TIRE

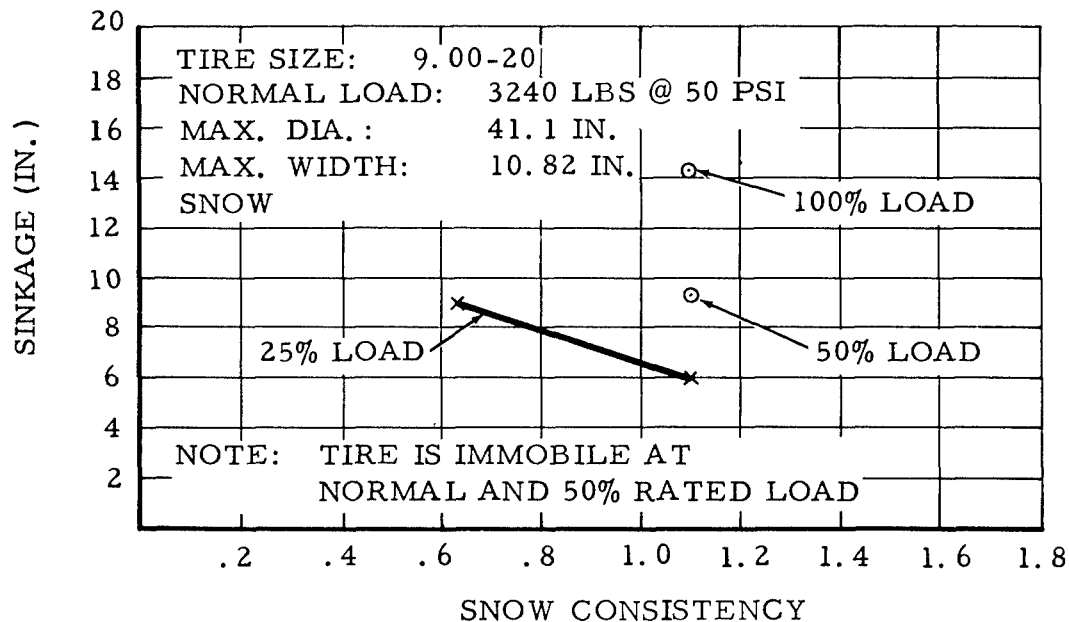


FIGURE B20. SINKAGE VS. SNOW CONSISTENCY, 9.00-20 TIRE

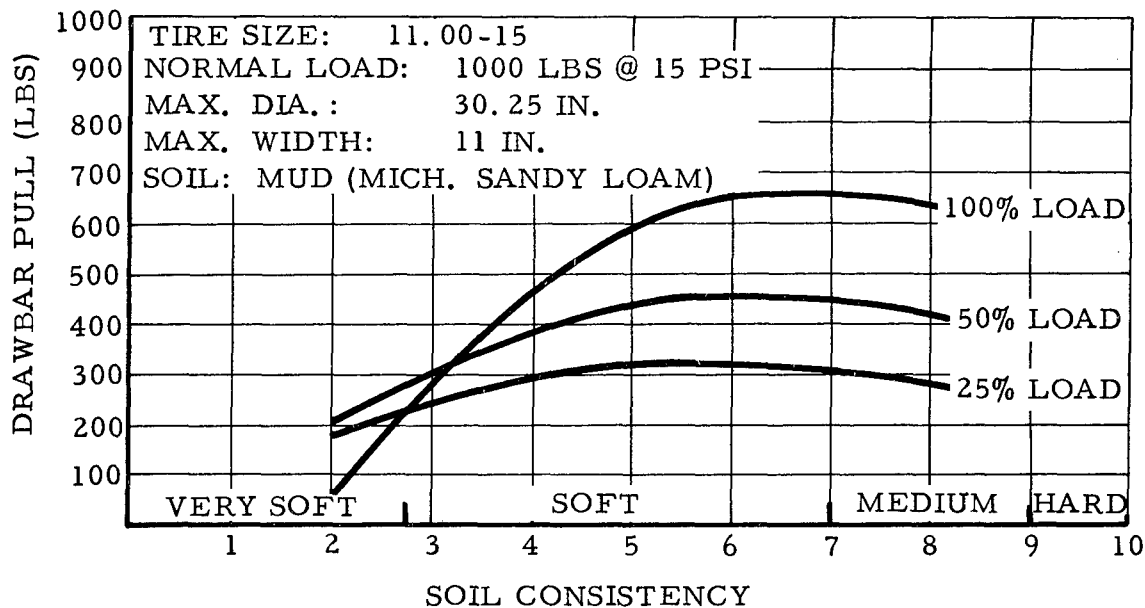


FIGURE B21. DRAWBAR PULL VS. SOIL CONSISTENCY,
 11.00-15 TIRE

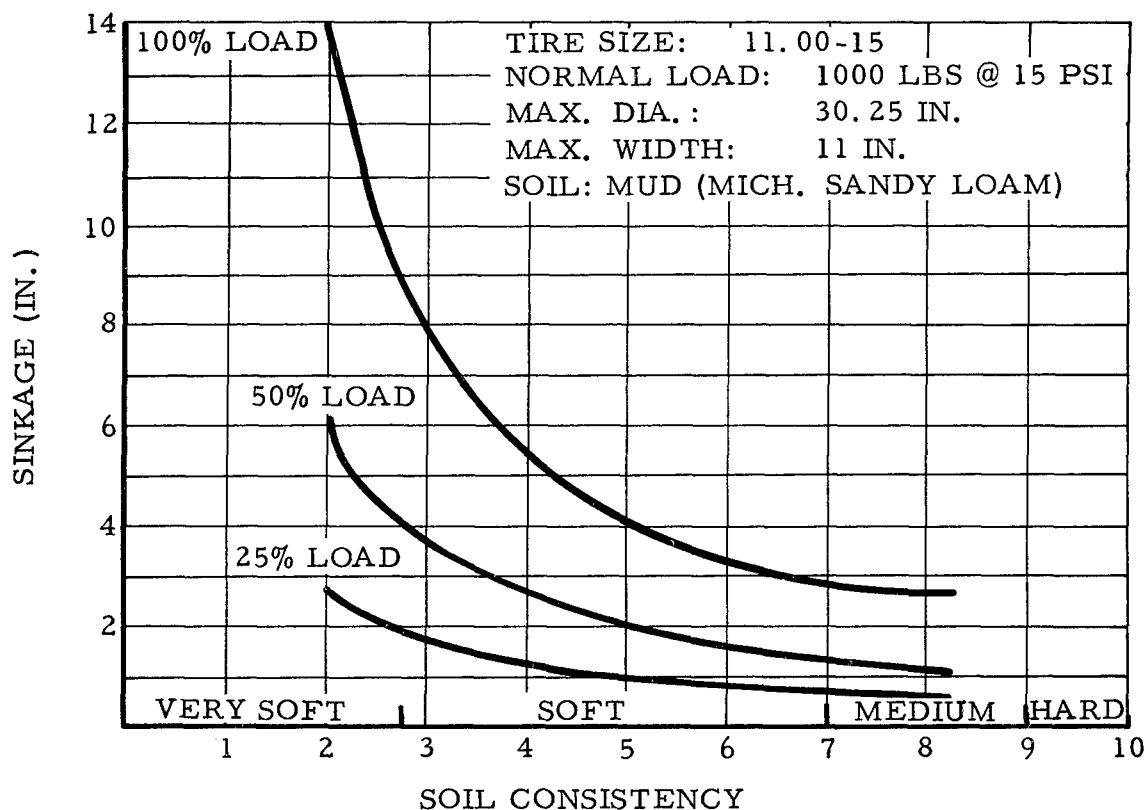


FIGURE B22. SINKAGE VS. SOIL CONSISTENCY,
 11.00-15 TIRE

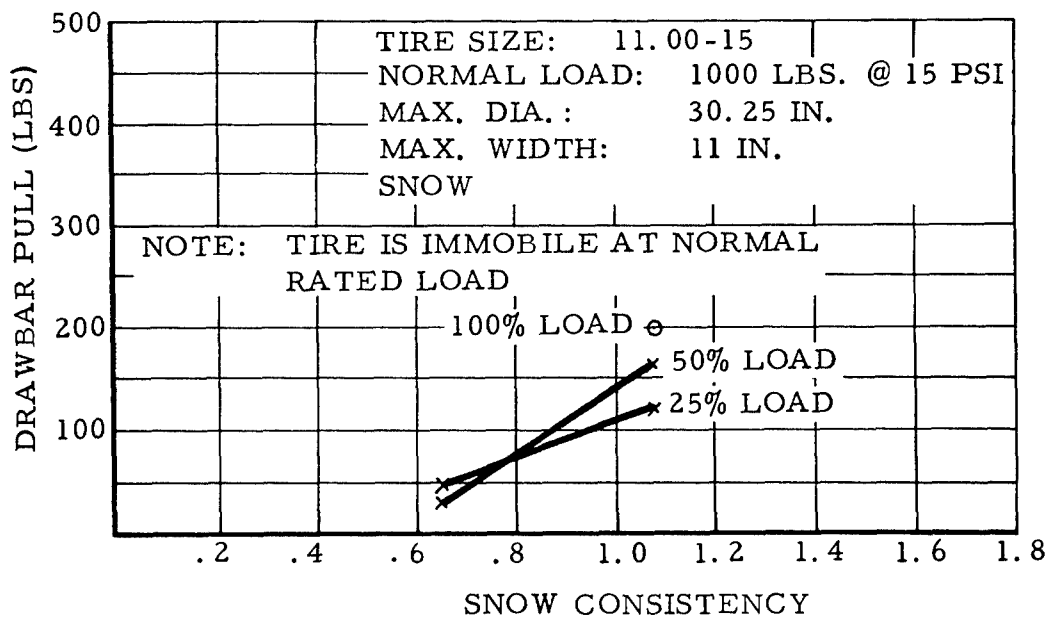


FIGURE B23. DRAWBAR PULL VS. SNOW CONSISTENCY, 11.00-15 TIRE

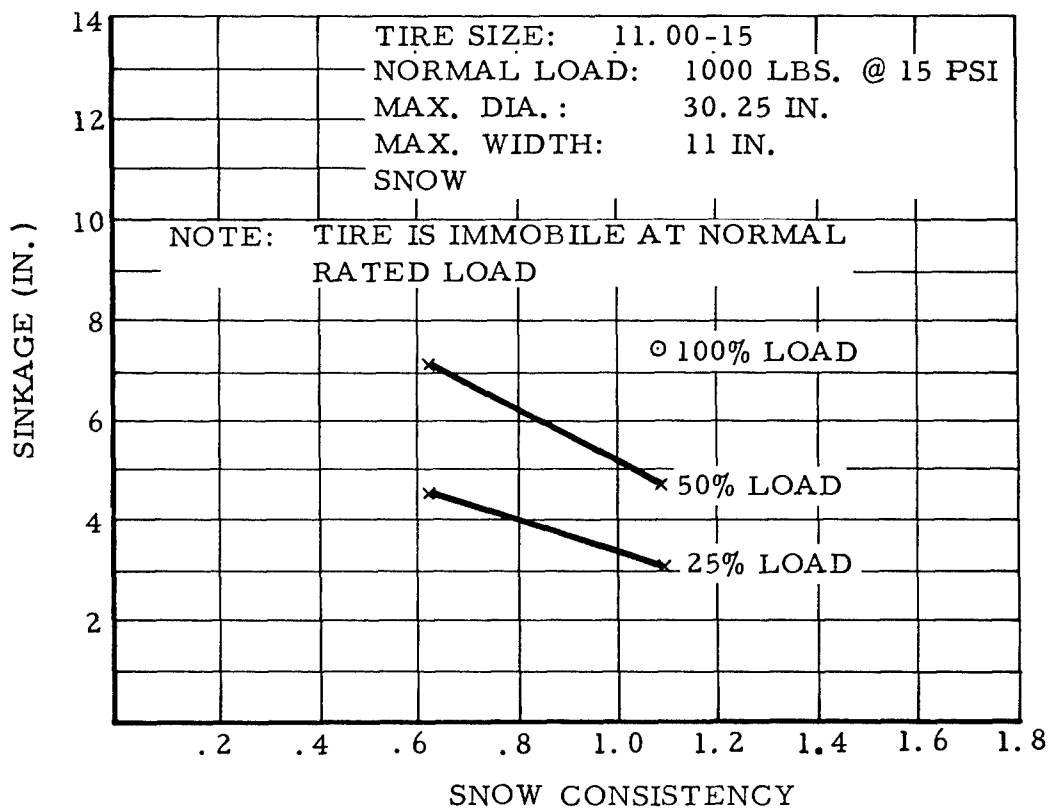


FIGURE B24. SINKAGE VS. SNOW CONSISTENCY, 11.00-15 TIRE

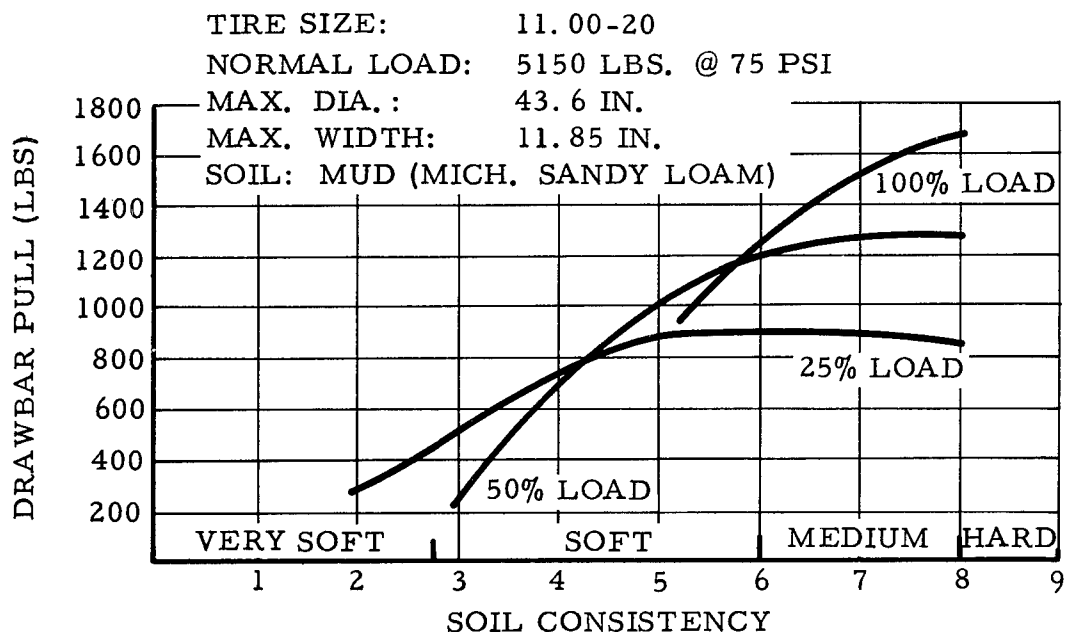


FIGURE B25. DRAWBAR PULL VS. SOIL CONSISTENCY, 11.00-20 TIRE

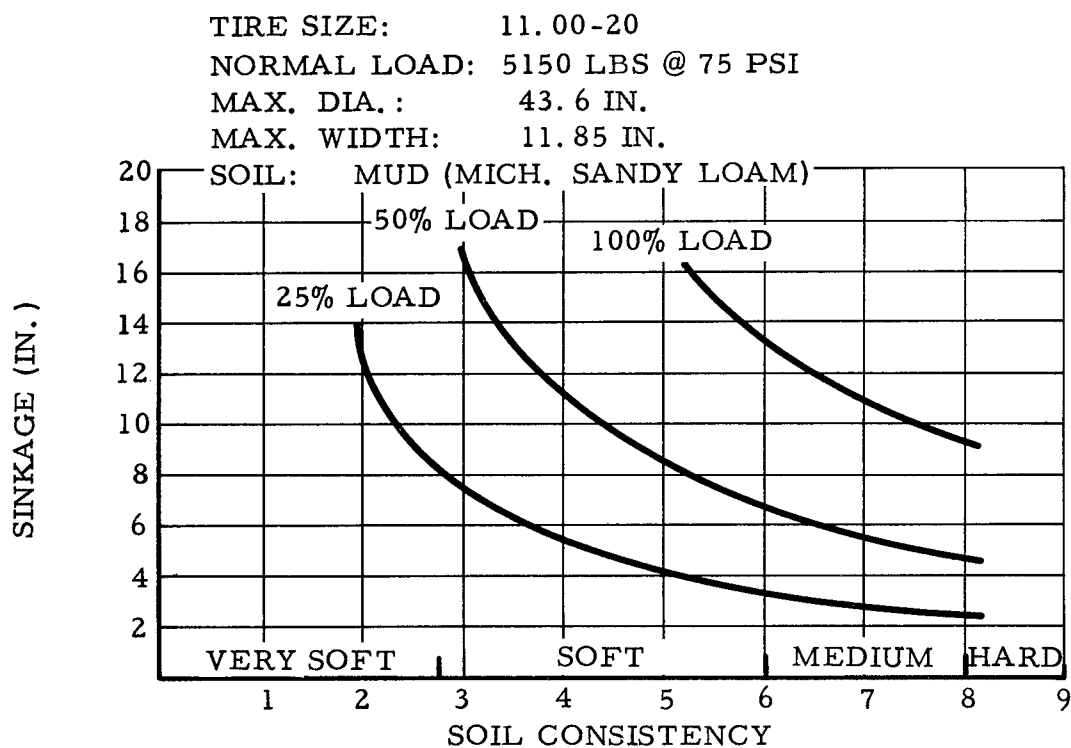


FIGURE B26. SINKAGE VS. SOIL CONSISTENCY, 11.00-20 TIRE

TIRE SIZE: 11.00-20
 NORMAL LOAD: 5150 LBS @ 75 PSI
 MAX. DIA.: 43.6 IN.
 MAX. WIDTH: 11.85 IN.

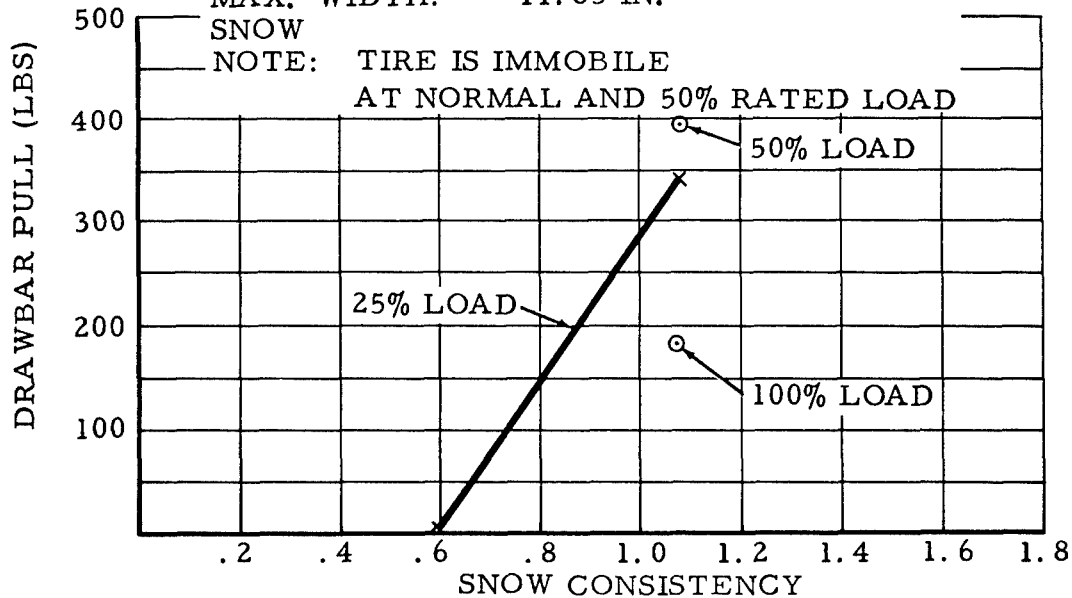


FIGURE B27. DRAWBAR PULL VS. SNOW CONSISTENCY,
 11-00-20 TIRE

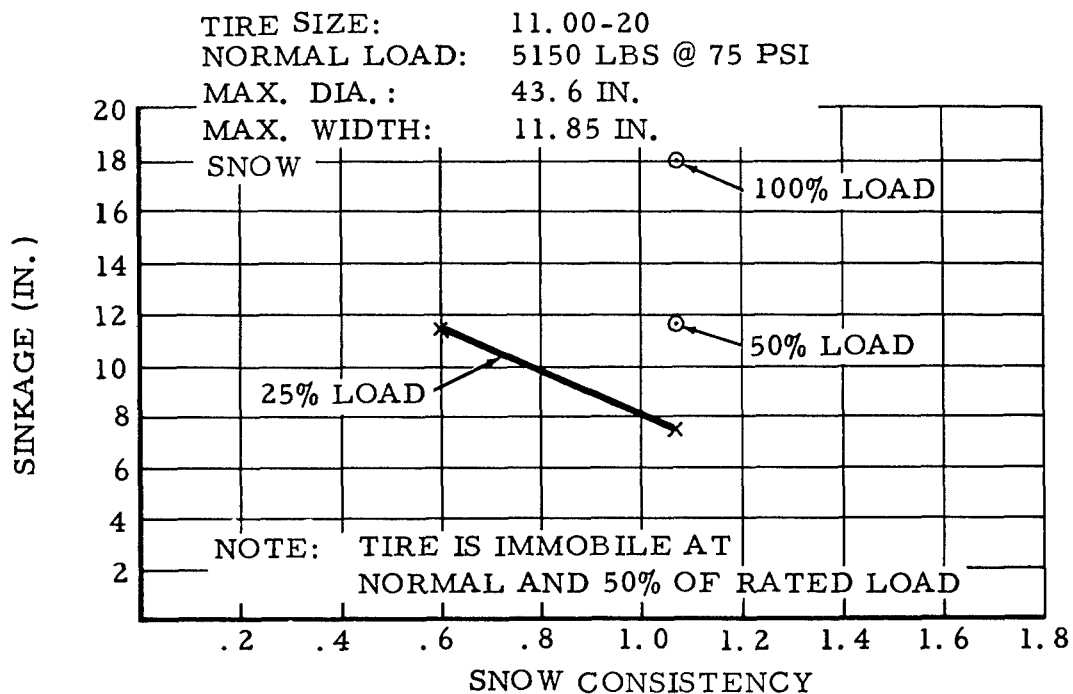


FIGURE B28. SINKAGE VS. SNOW CONSISTENCY,
 11.00-20 TIRE

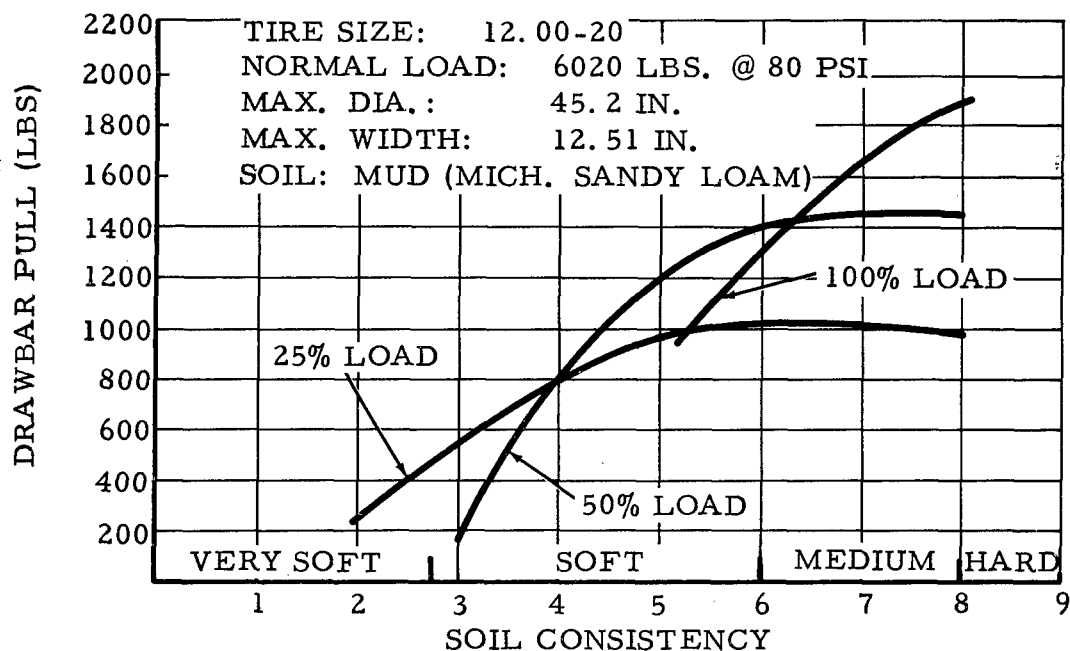


FIGURE B29. DRAWBAR PULL VS. SOIL CONSISTENCY, 12.00-20 TIRE

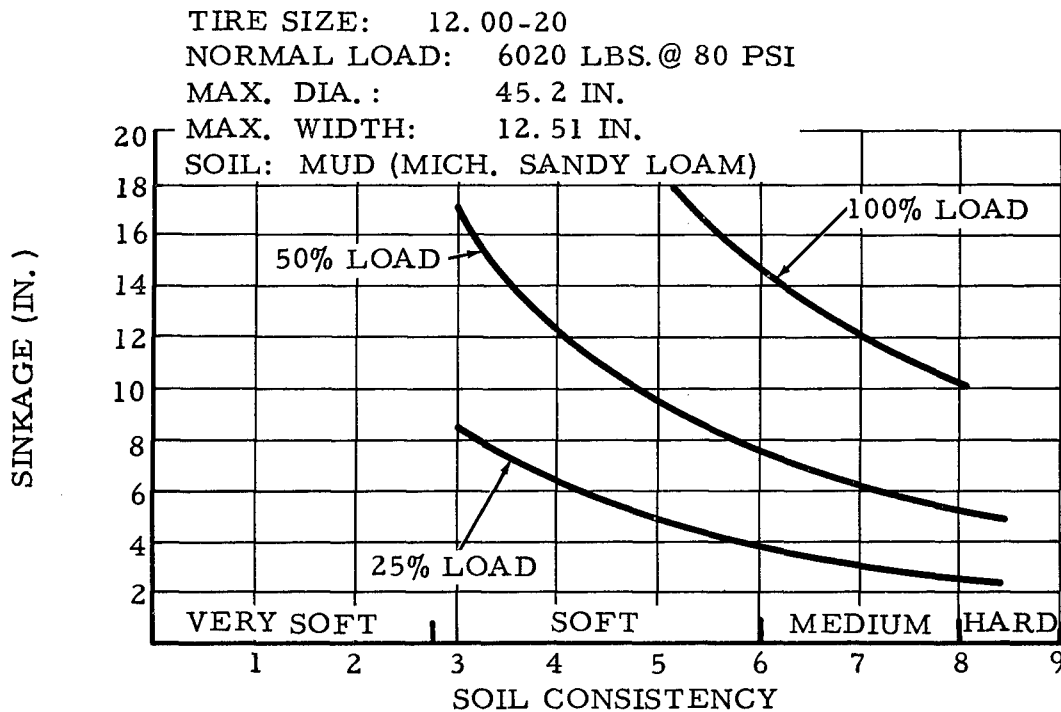


FIGURE B30. SINKAGE VS. SOIL CONSISTENCY, 12.00-20 TIRE

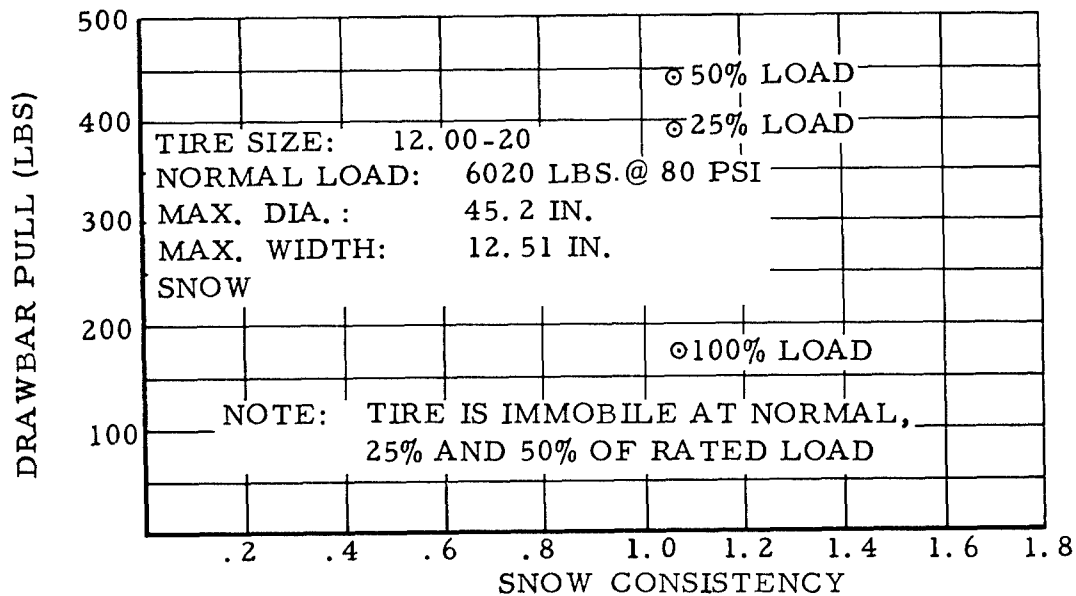


FIGURE B31. DRAWBAR PULL VS. SNOW CONSISTENCY, 12.00-20 TIRE

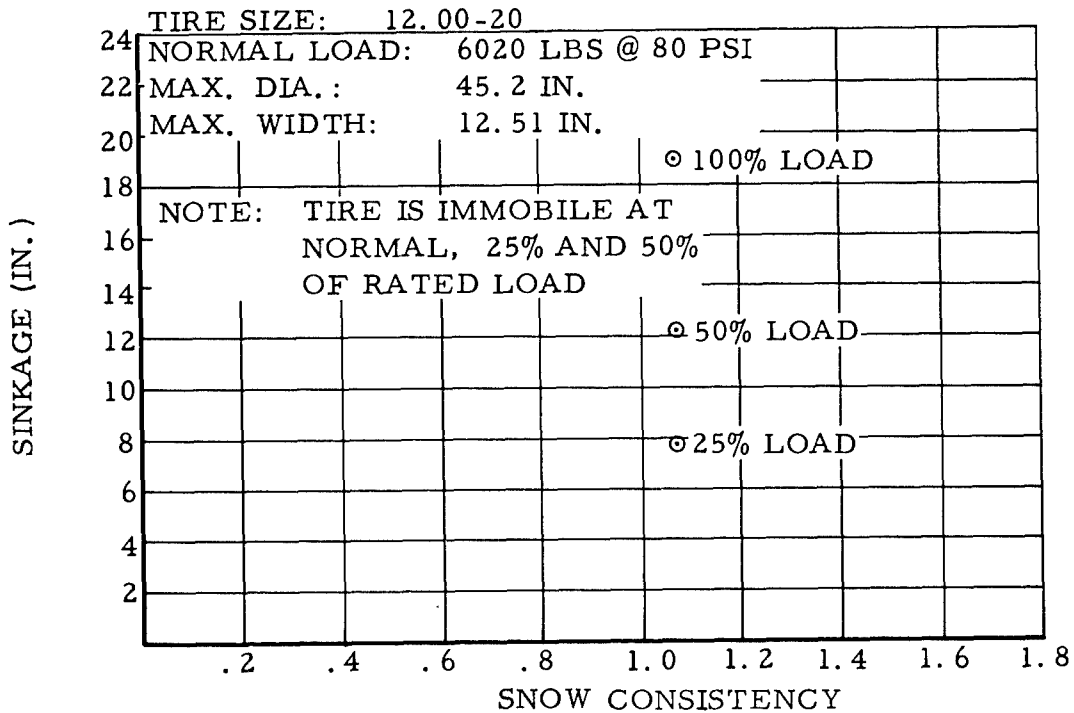


FIGURE B32. SINKAGE VS. SNOW CONSISTENCY, 12.00-20 TIRE

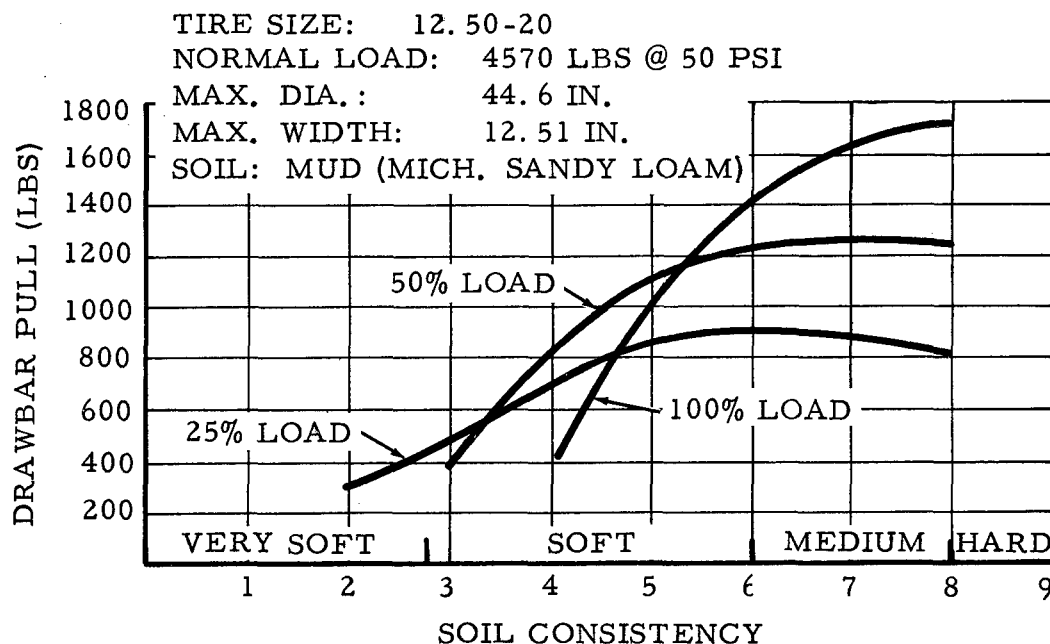


FIGURE B33. DRAWBAR PULL VS. SOIL CONSISTENCY,
 12.50-20 TIRE

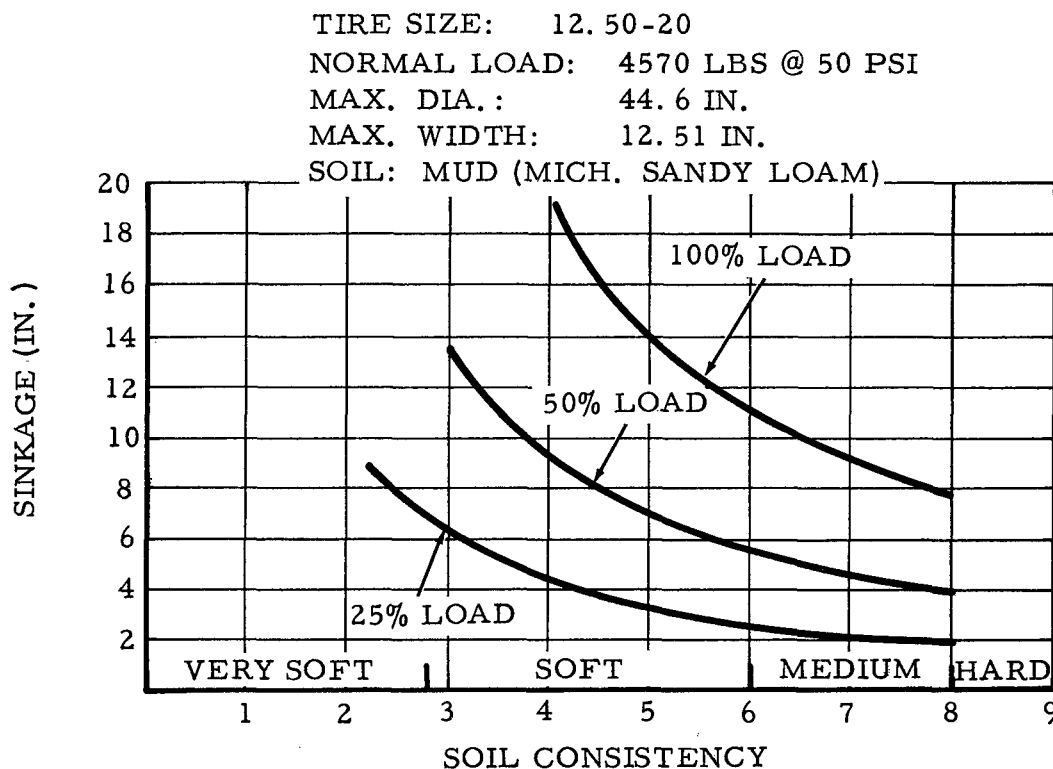


FIGURE B34. SINKAGE VS. SOIL CONSISTENCY,
 12.50-20 TIRE

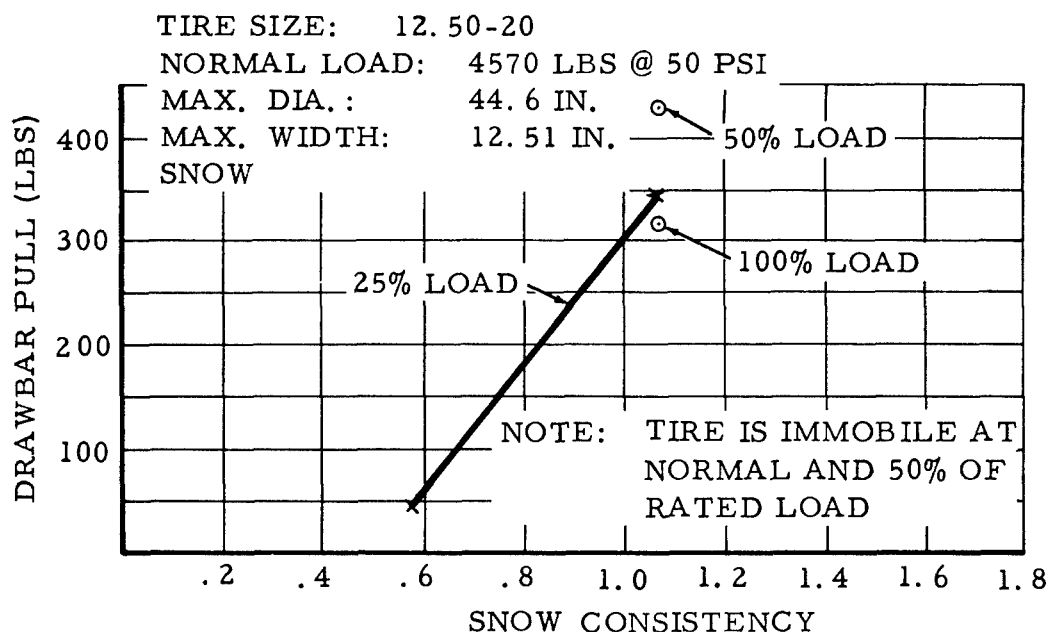


FIGURE B35. DRAWBAR PULL VS. SNOW CONSISTENCY,
 12.50-20 TIRE

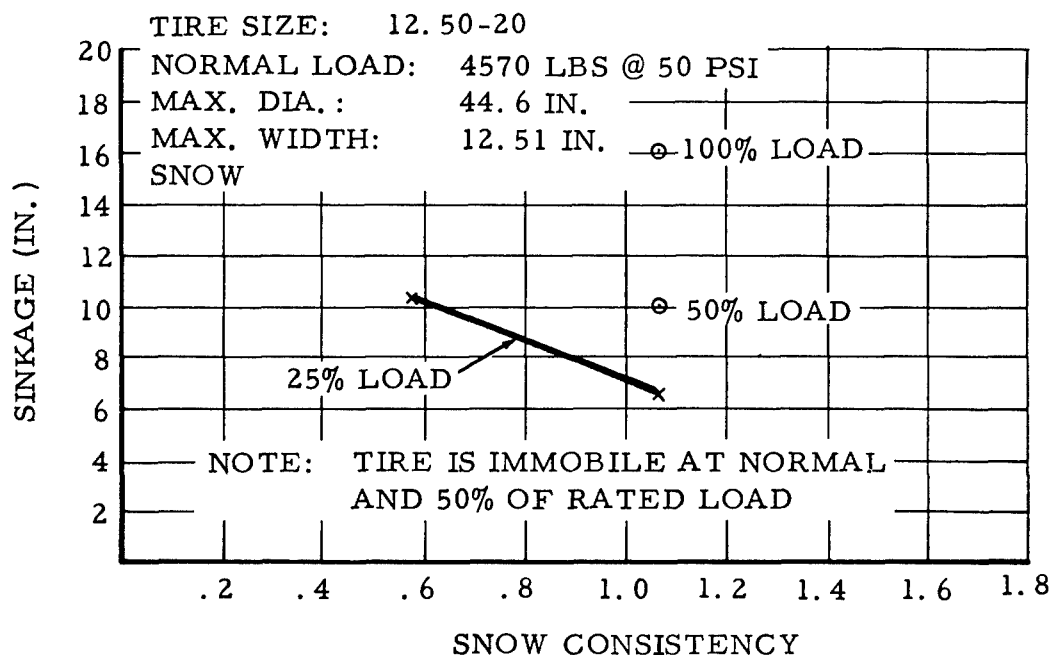


FIGURE B36. SINKAGE VS. SNOW CONSISTENCY,
 12.50-20 TIRE

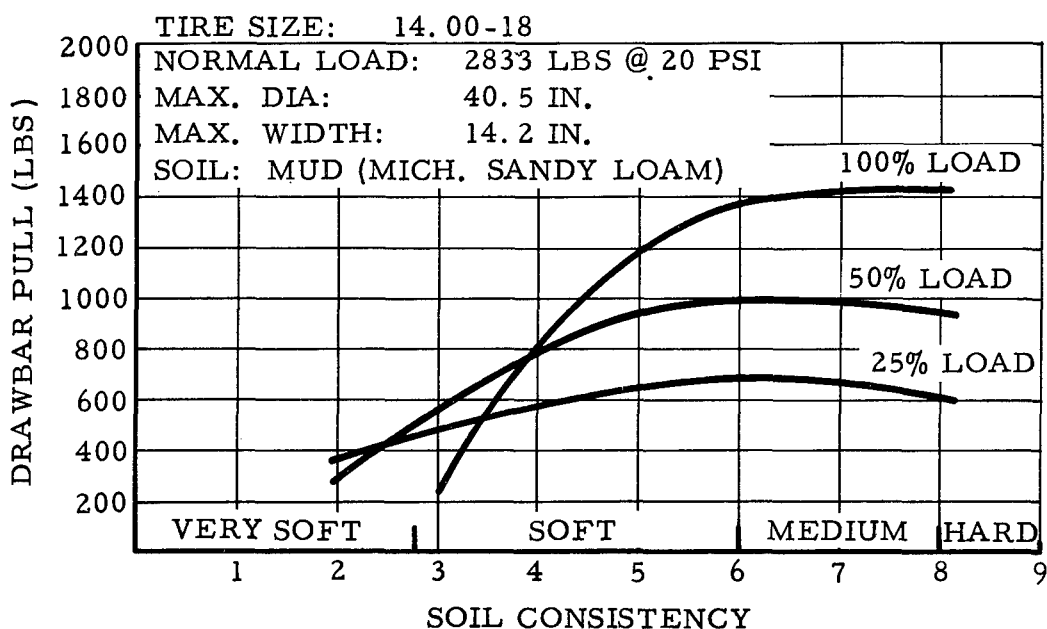


FIGURE B37. DRAWBAR PULL VS. SOIL CONSISTENCY,
14.00-18 TIRE

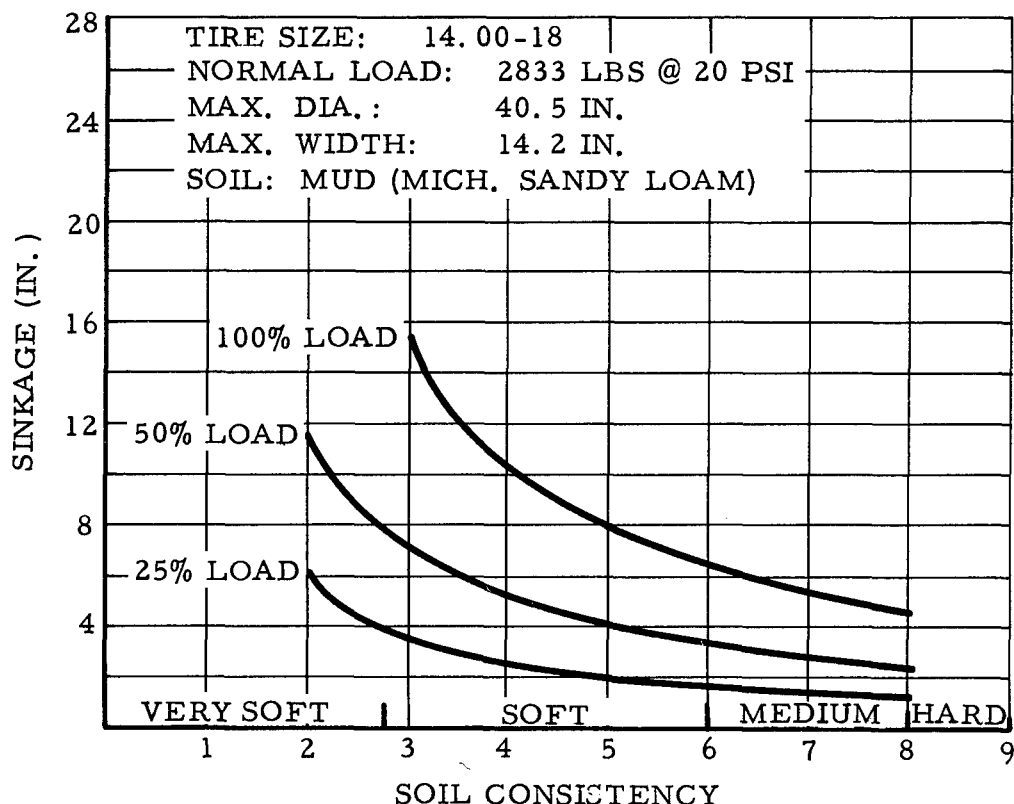


FIGURE B38. SINKAGE VS. SOIL CONSISTENCY,
14.00-18 TIRE

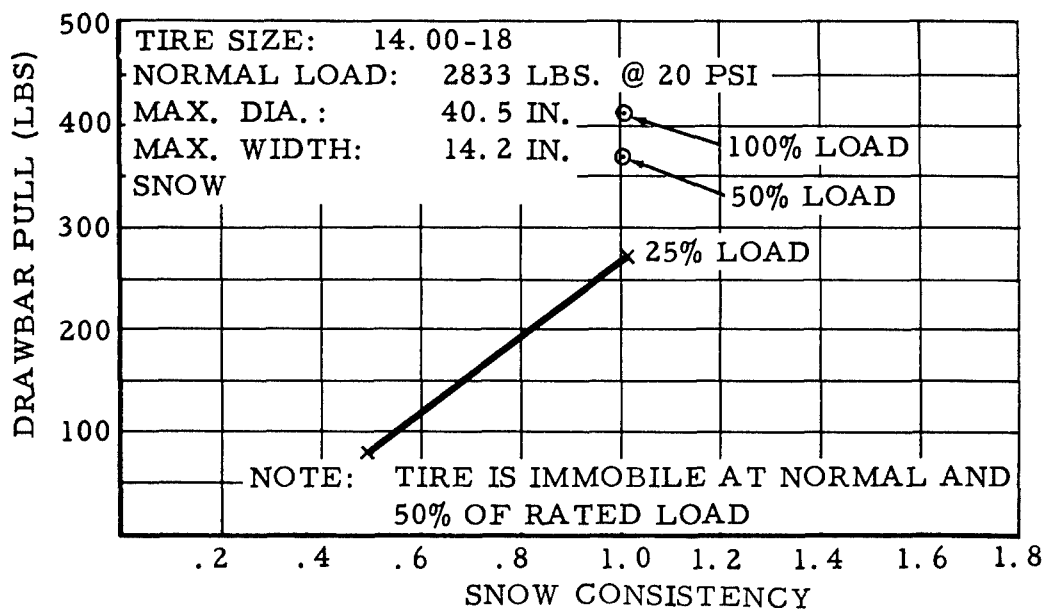


FIGURE B39. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-18 TIRE

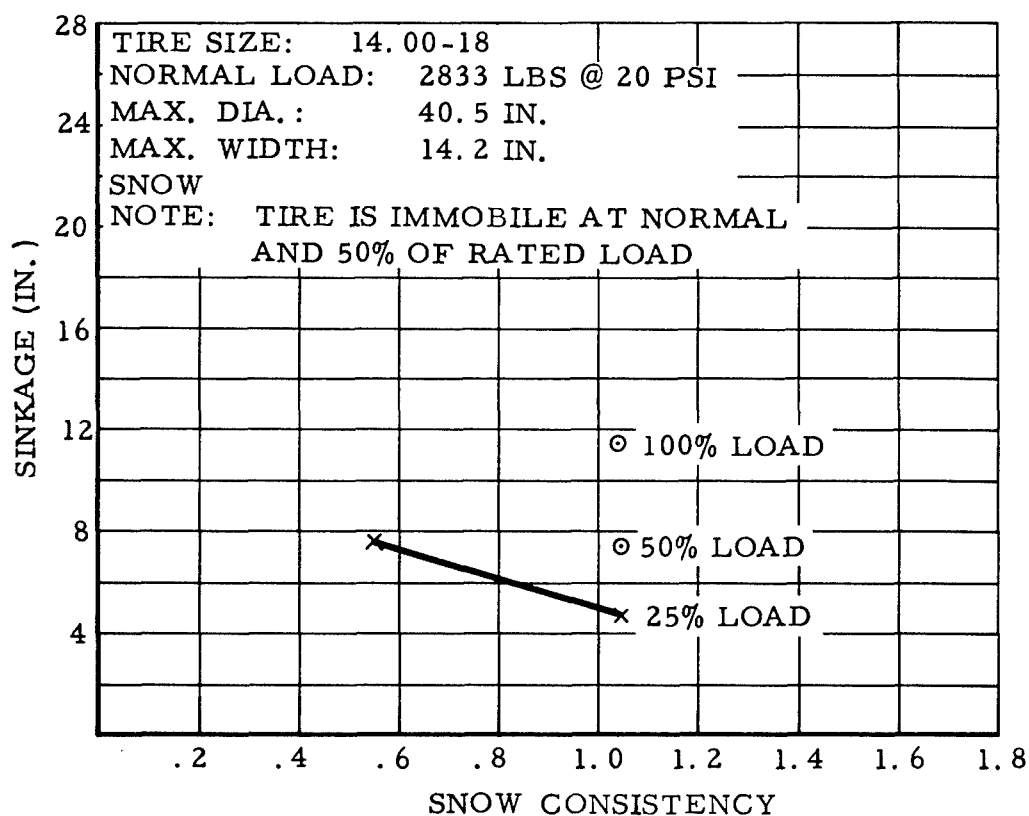


FIGURE B40. SINKAGE VS. SNOW CONSISTENCY, 14.00-18 TIRE

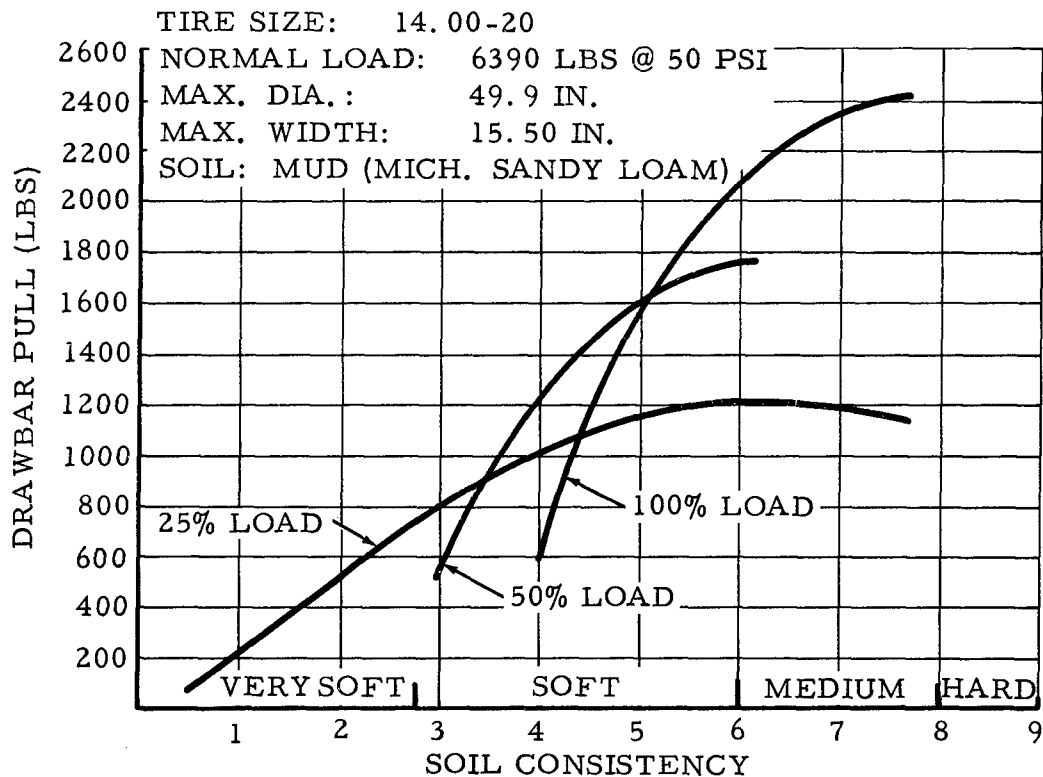


FIGURE B41. DRAWBAR PULL VS. SOIL CONSISTENCY, 14.00-20 TIRE

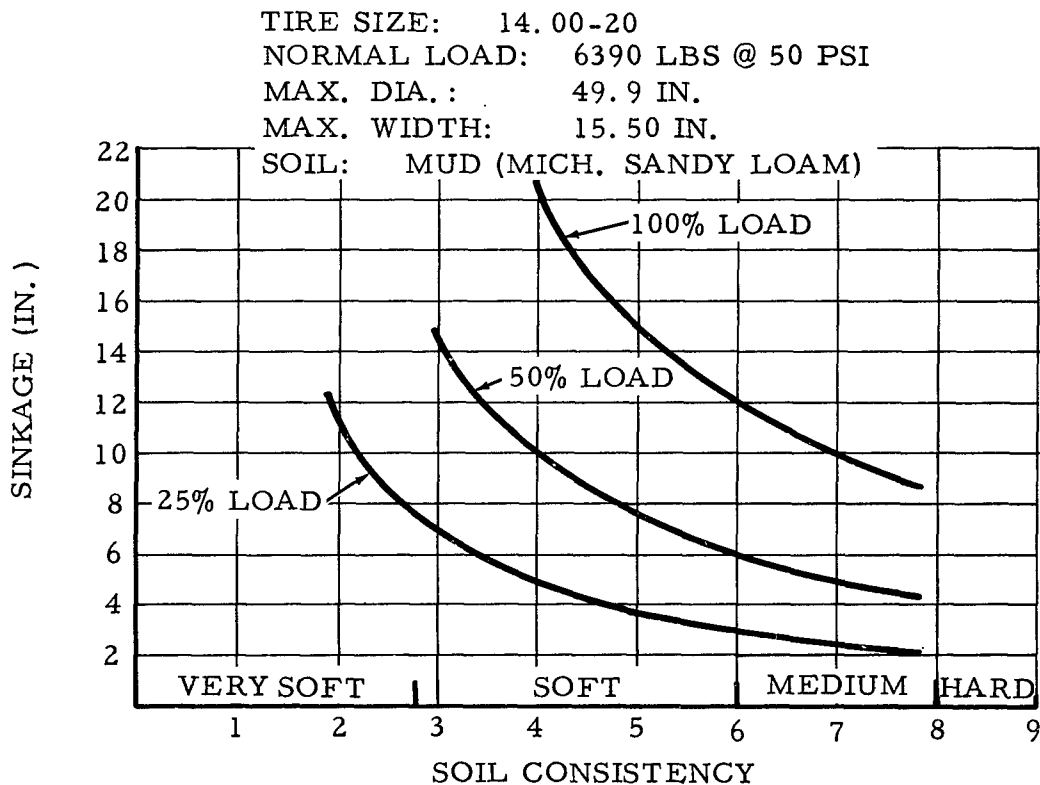


FIGURE B42. SINKAGE VS. SOIL CONSISTENCY, 14.00-20 TIRE

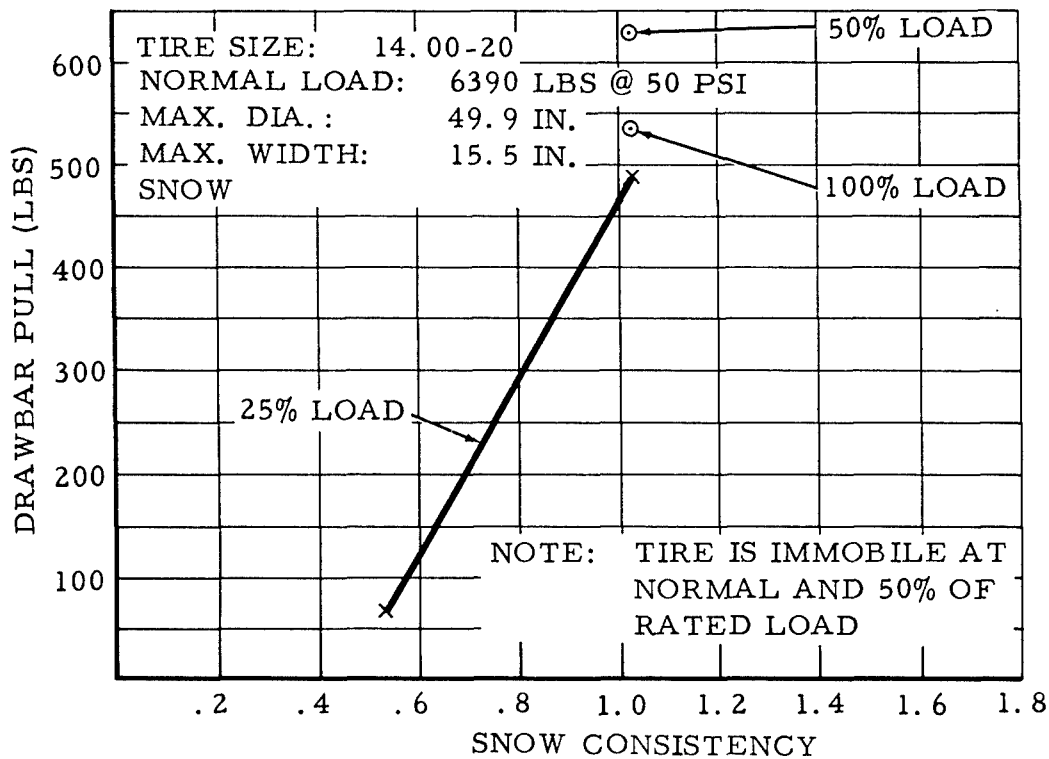


FIGURE B43. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-20 TIRE

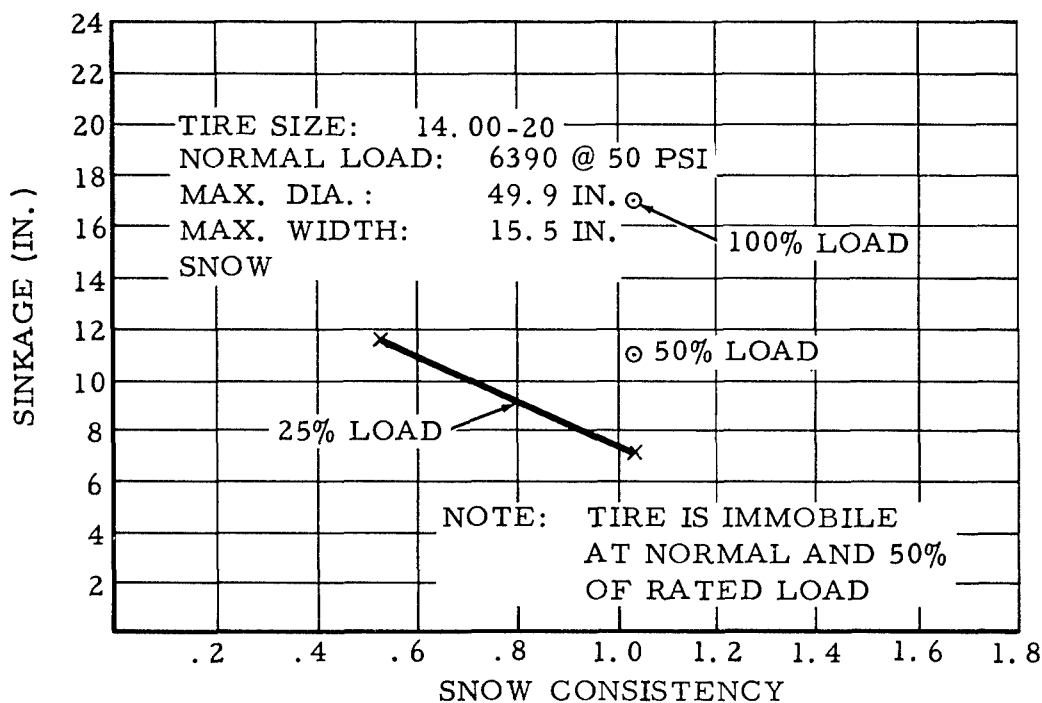


FIGURE B44. SINKAGE VS. SNOW CONSISTENCY, 14.00-20 TIRE

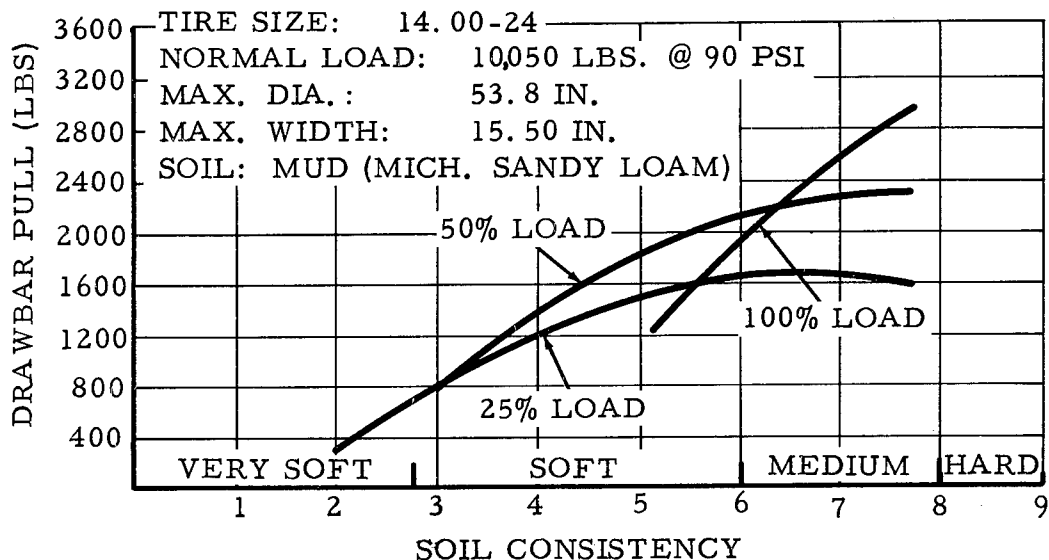


FIGURE B45. DRAWBAR PULL VS. SOIL CONSISTENCY,
 14.00-24 TIRE

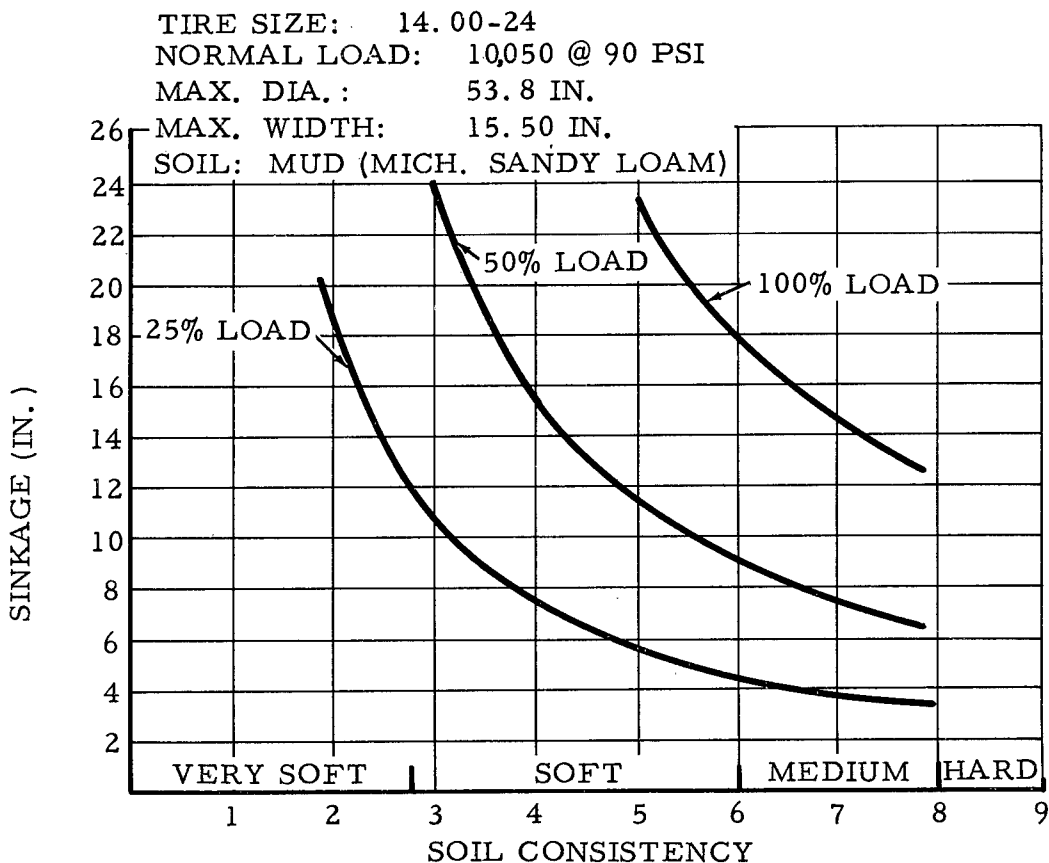


FIGURE B46. SINKAGE VS. SOIL CONSISTENCY,
 14.00-24 TIRE

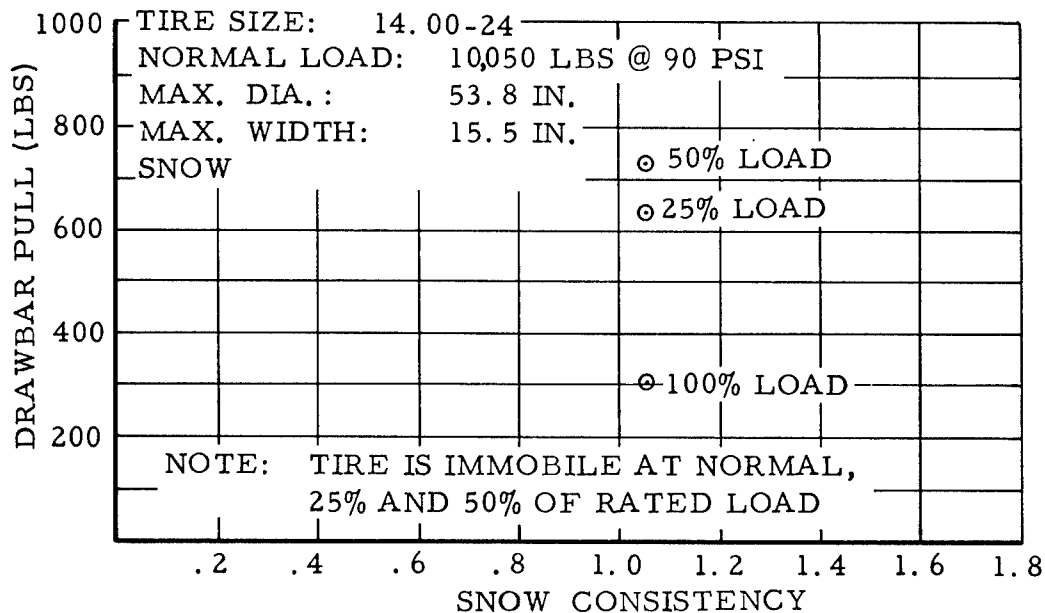


FIGURE B47. DRAWBAR PULL VS. SNOW CONSISTENCY, 14.00-24 TIRE

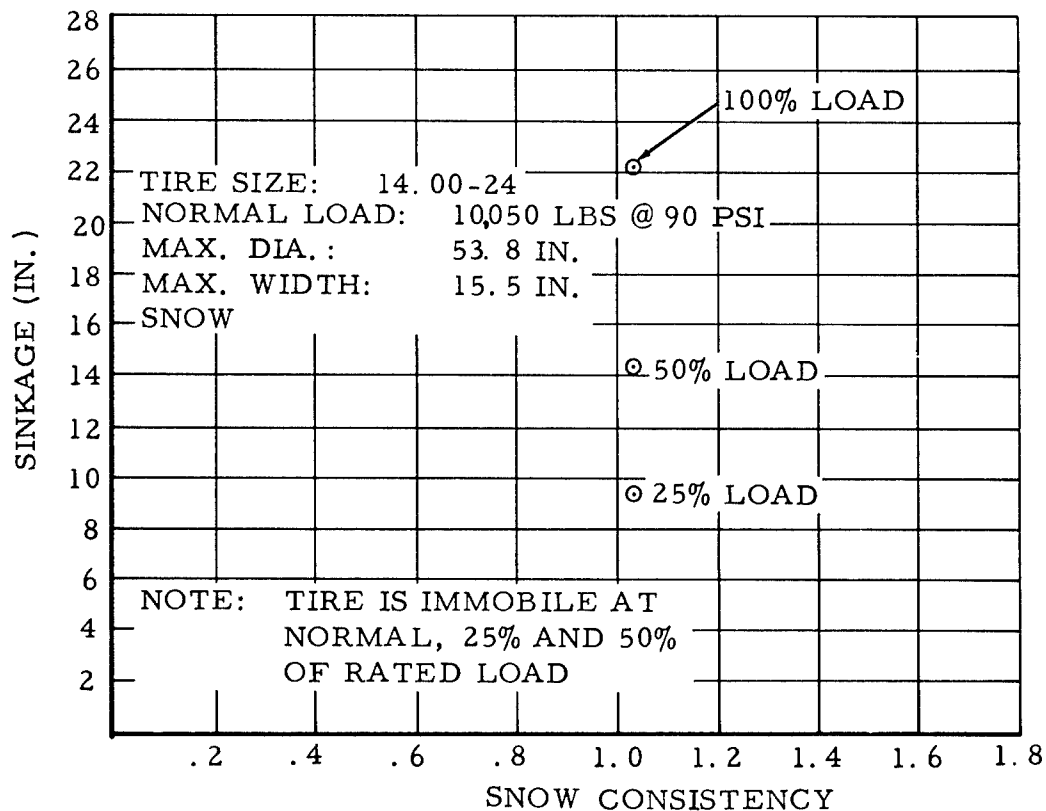


FIGURE B48 SINKAGE VS. SNOW CONSISTENCY, 14.00-24 TIRE

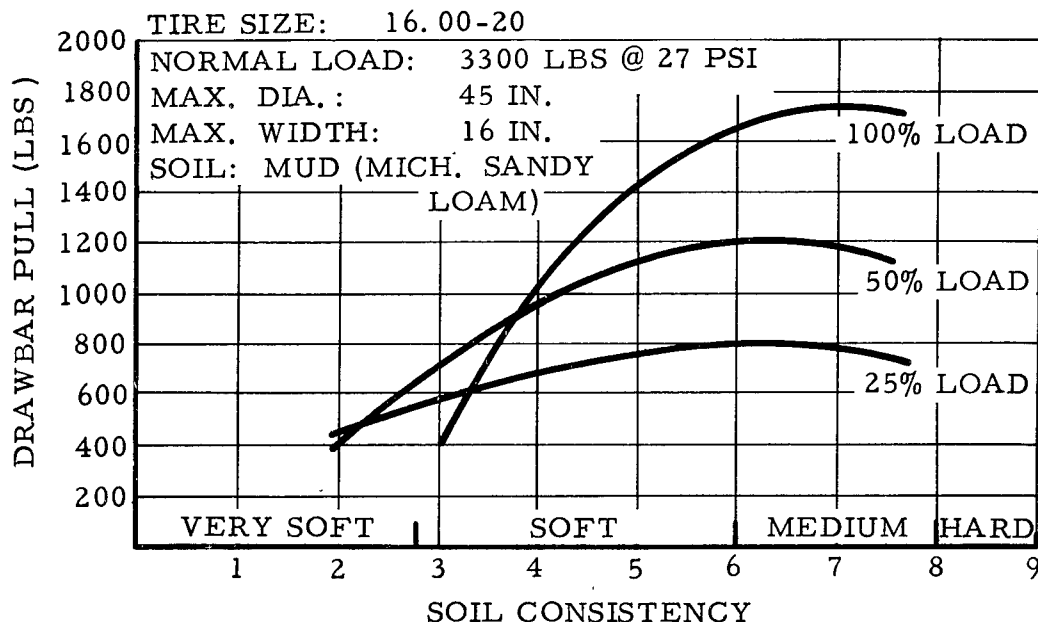


FIGURE B49. DRAWBAR PULL VS. SOIL CONSISTENCY,
 16.00-20 TIRE

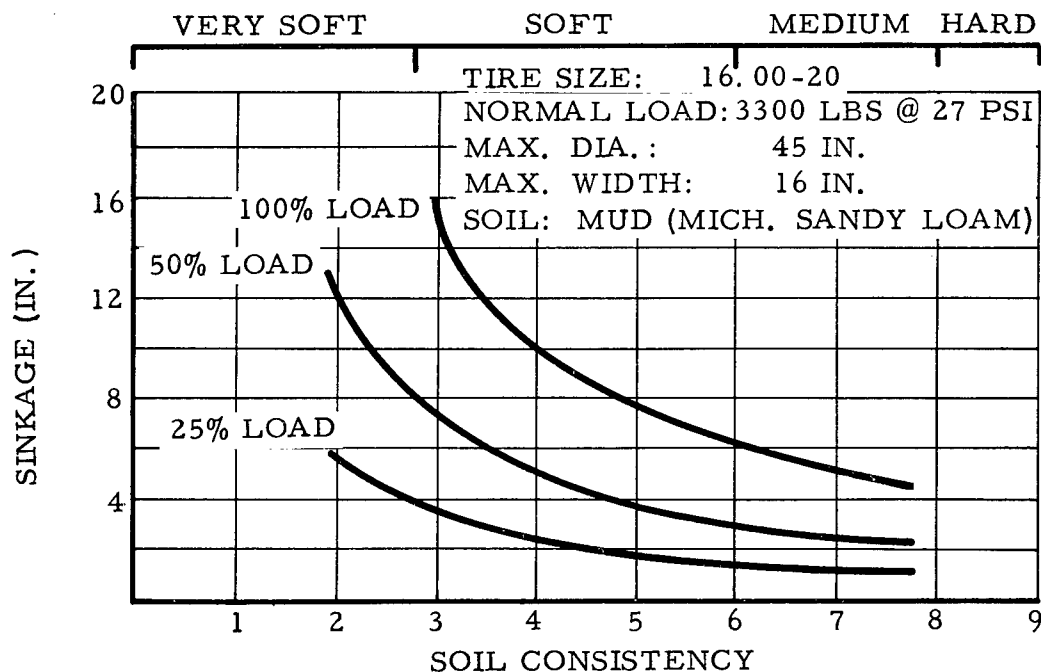


FIGURE B50. SINKAGE VS. SOIL CONSISTENCY,
 16.00-20 TIRE

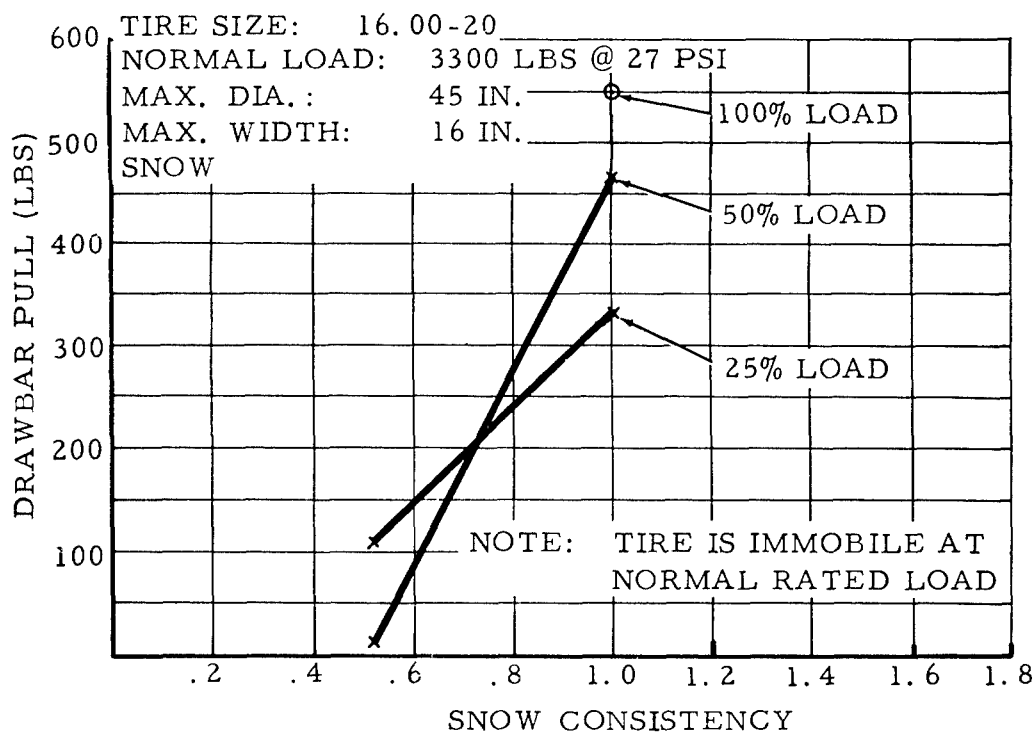


FIGURE B51. DRAWBAR PULL VS. SNOW CONSISTENCY, 16.00-20 TIRE

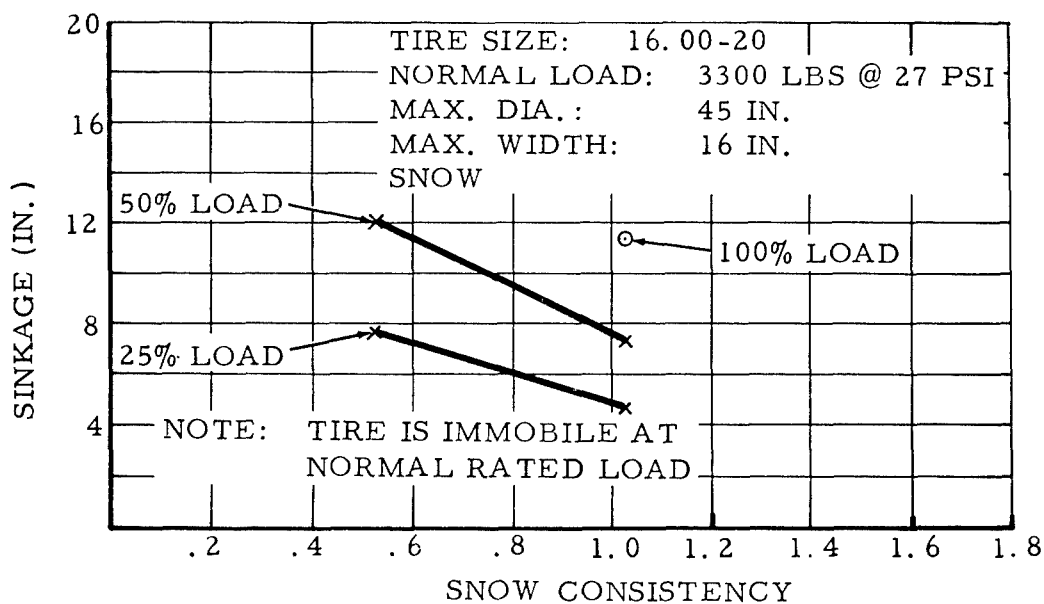


FIGURE B52. SINKAGE VS. SNOW CONSISTENCY, 16.00-20 TIRE

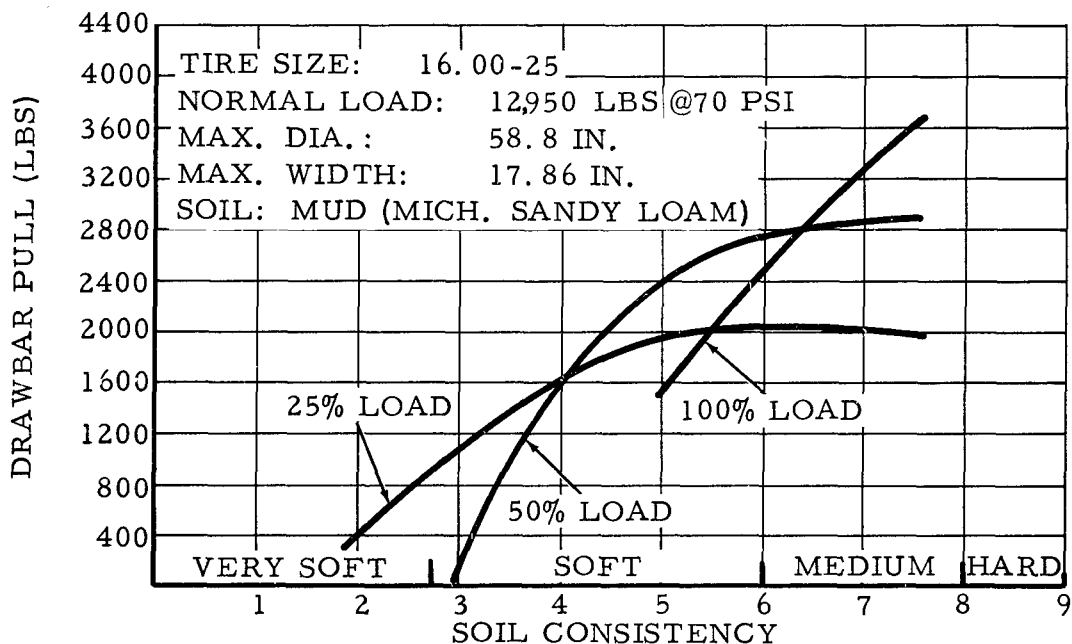


FIGURE B53. DRAWBAR PULL VS. SOIL CONSISTENCY, 16.00-25 TIRE

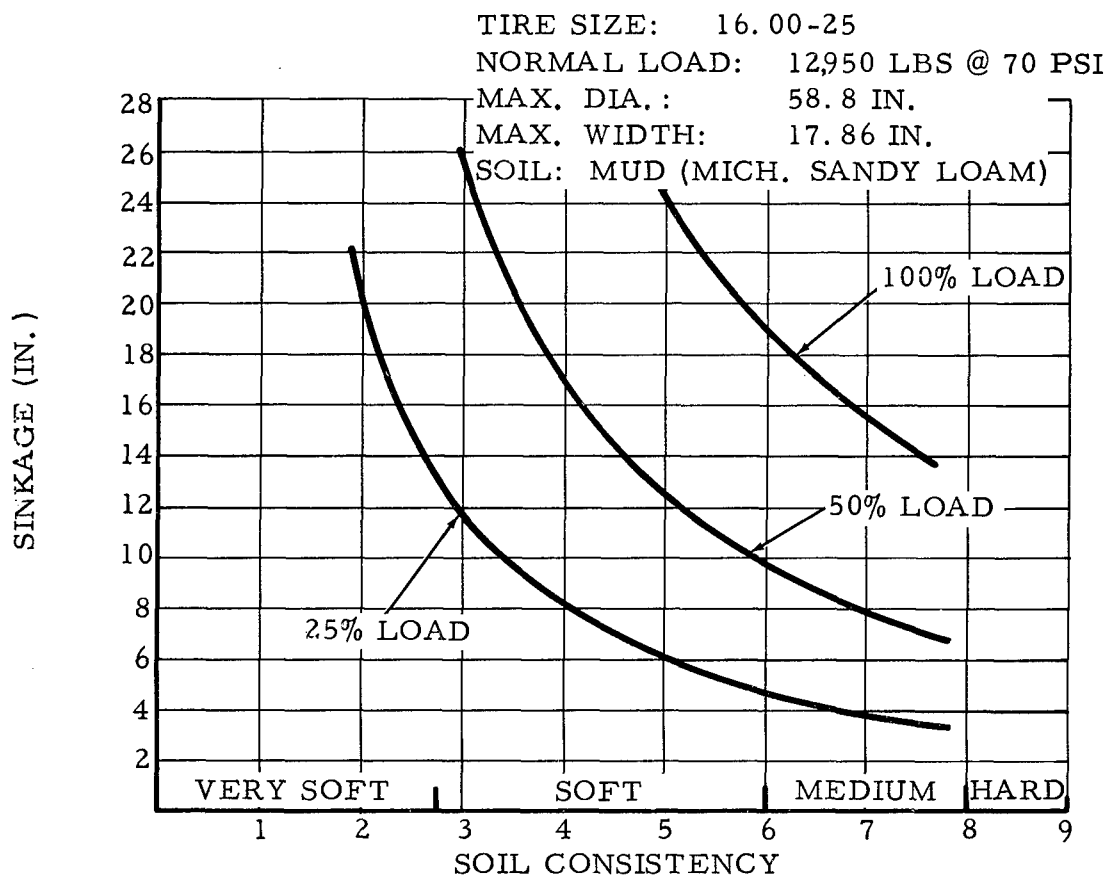


FIGURE B54. SINKAGE VS. SOIL CONSISTENCY, 16.00-25 TIRE

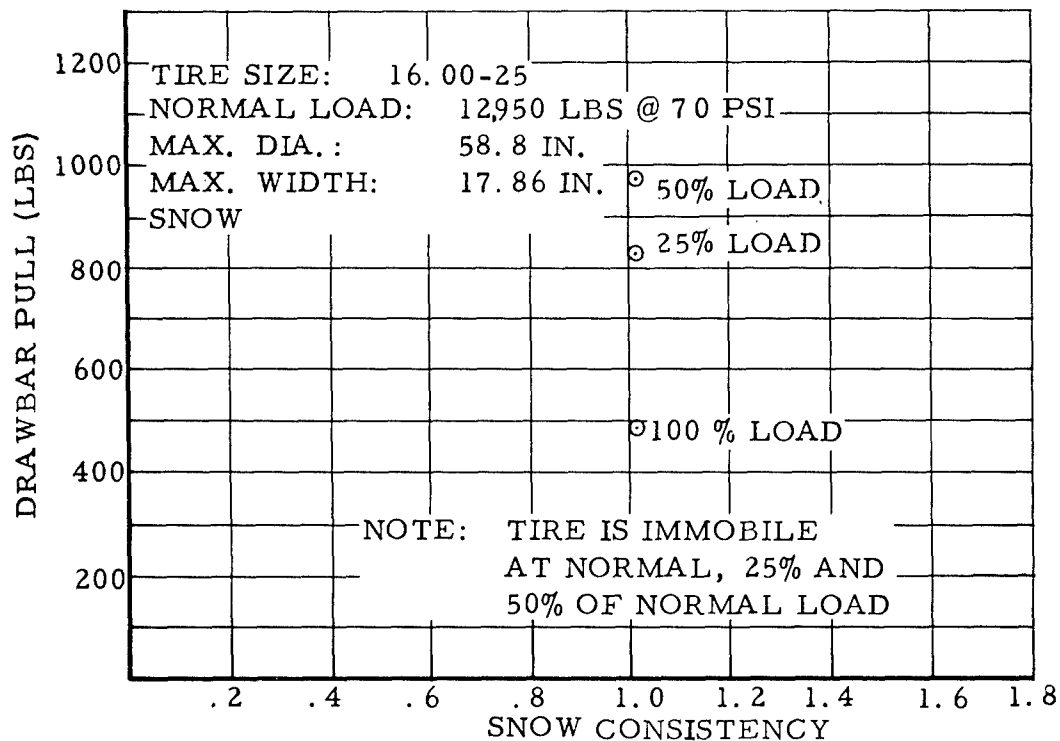


FIGURE B55. DRAWBAR PULL VS. SNOW CONSISTENCY, 16.00-25 TIRE

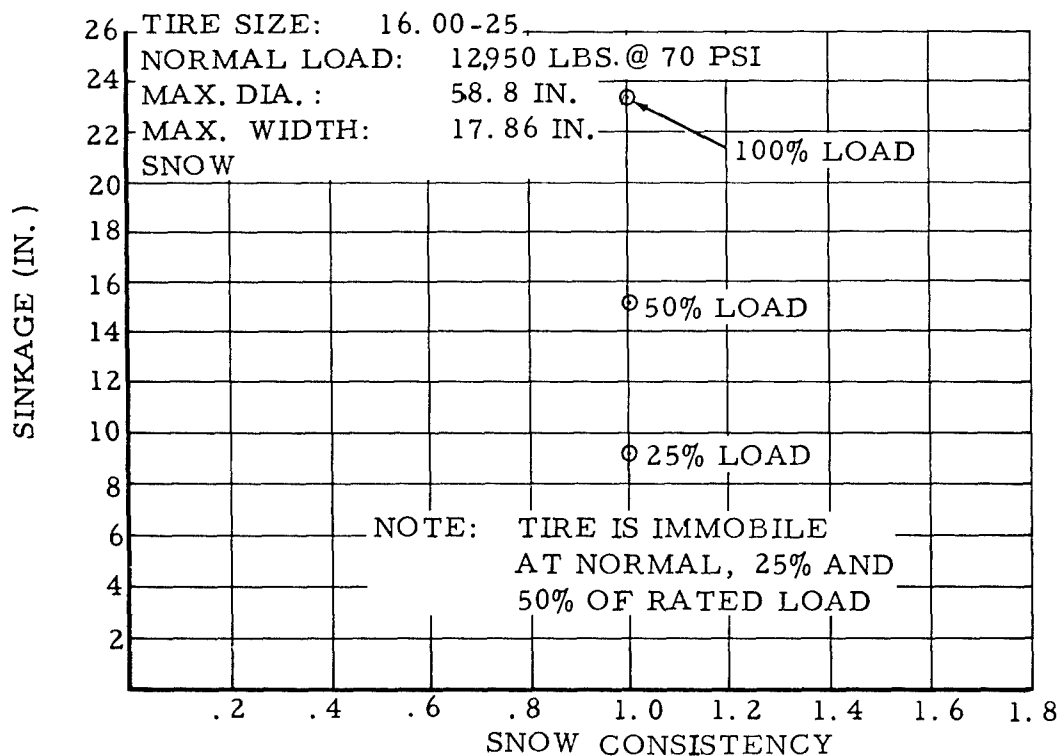


FIGURE B56. SINKAGE VS. SNOW CONSISTENCY, 16.00-25 TIRE

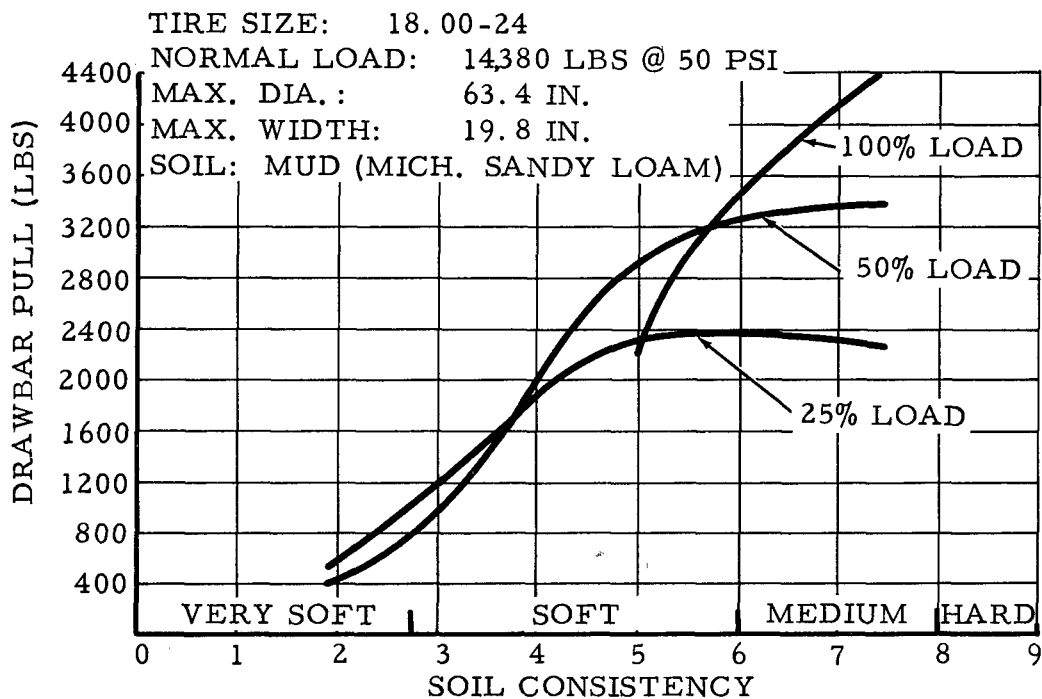


FIGURE B57. DRAWBAR PULL VS. SOIL CONSISTENCY, 18.00-24 TIRE

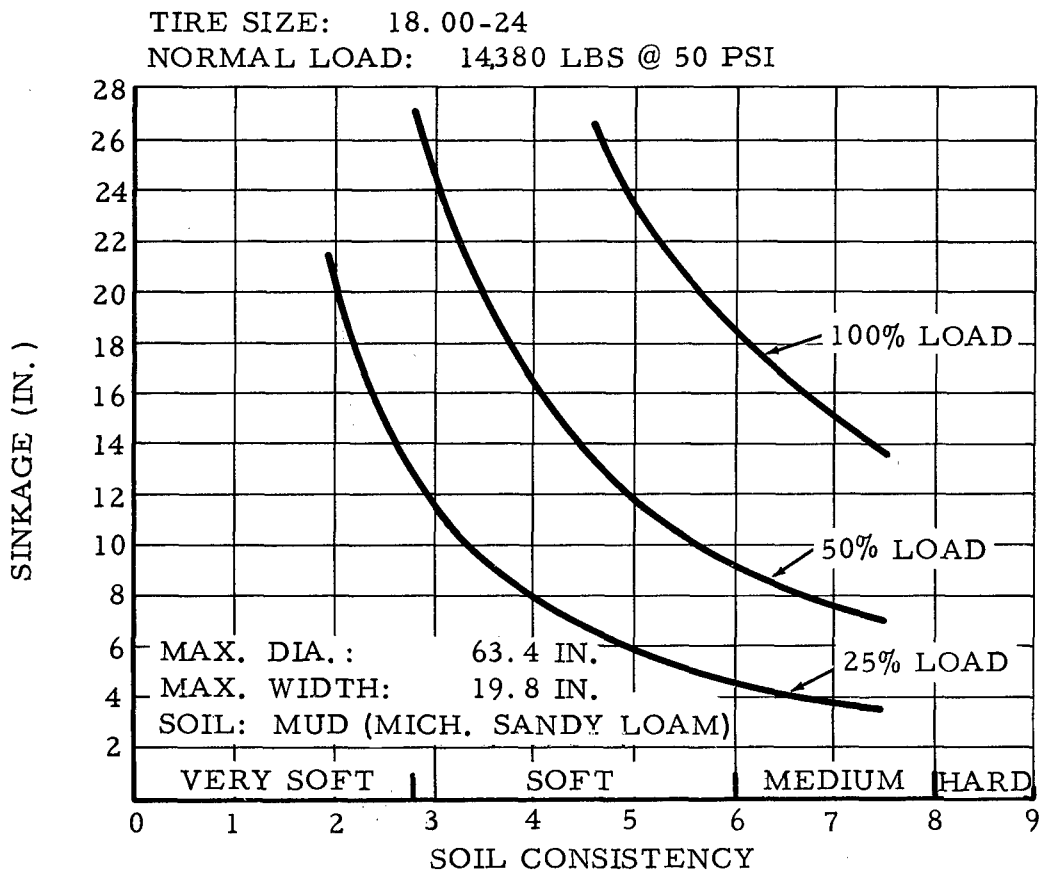


FIGURE B58. SINKAGE VS. SOIL CONSISTENCY, 18.00-24 TIRE

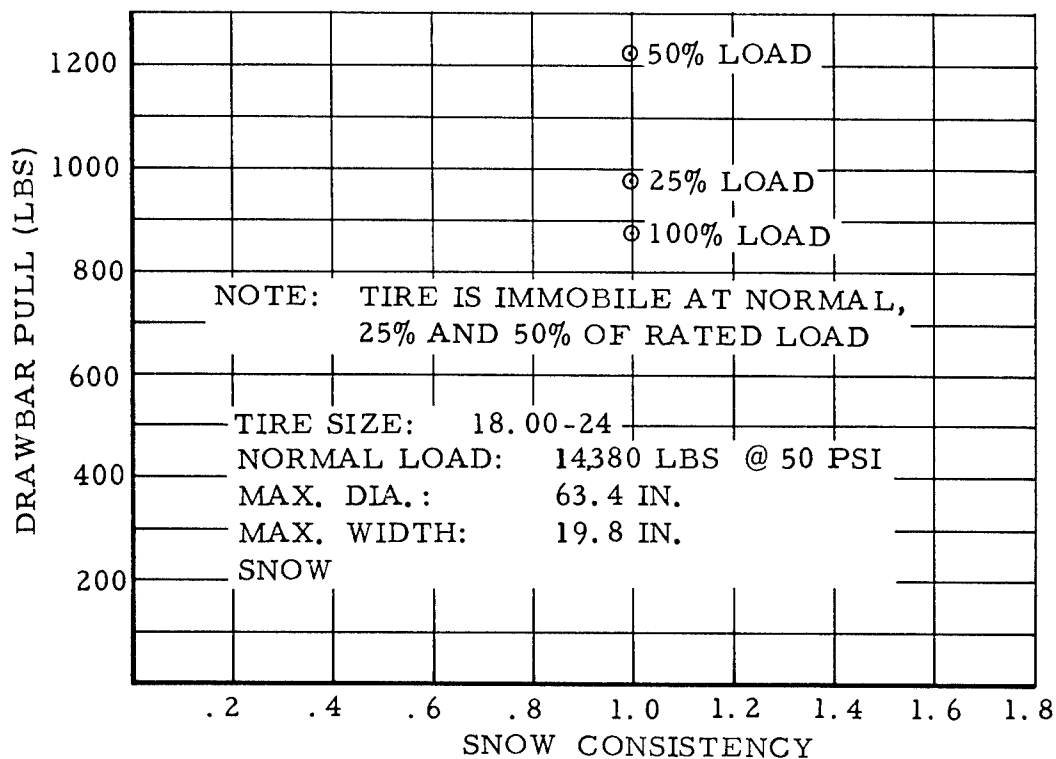


FIGURE B59. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-24 TIRE

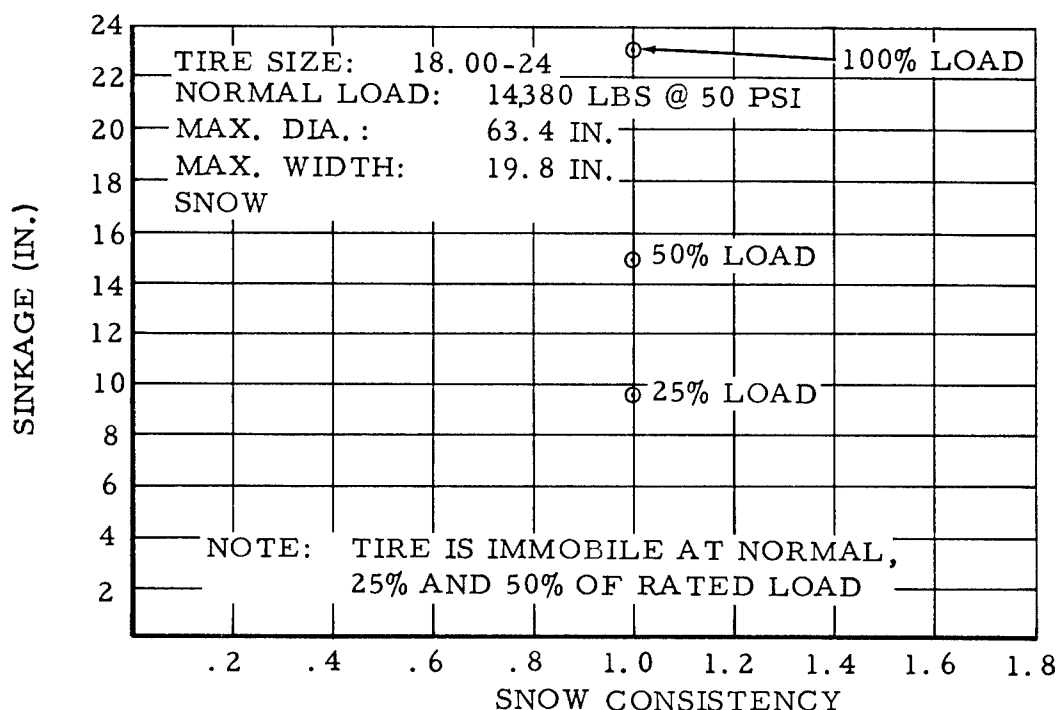


FIGURE B60. SINKAGE VS. SNOW CONSISTENCY, 18.00-24 TIRE

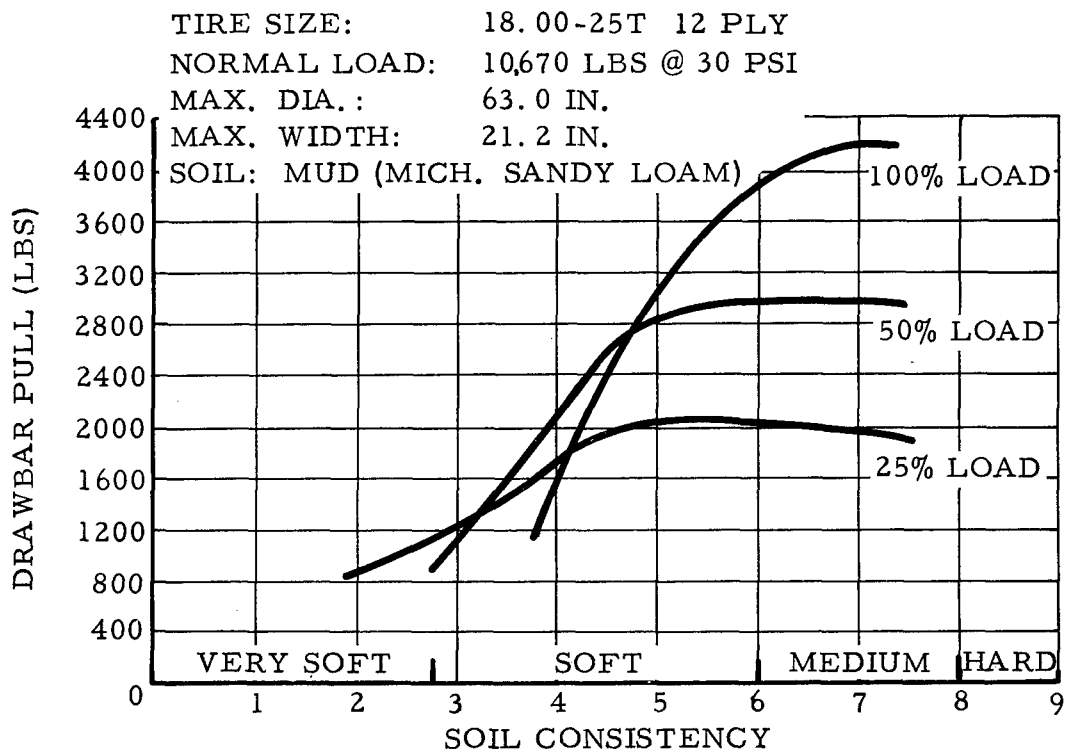


FIGURE B61. DRAWBAR PULL VS. SOIL CONSISTENCY, 18.00-25T, 12 PLY TIRE

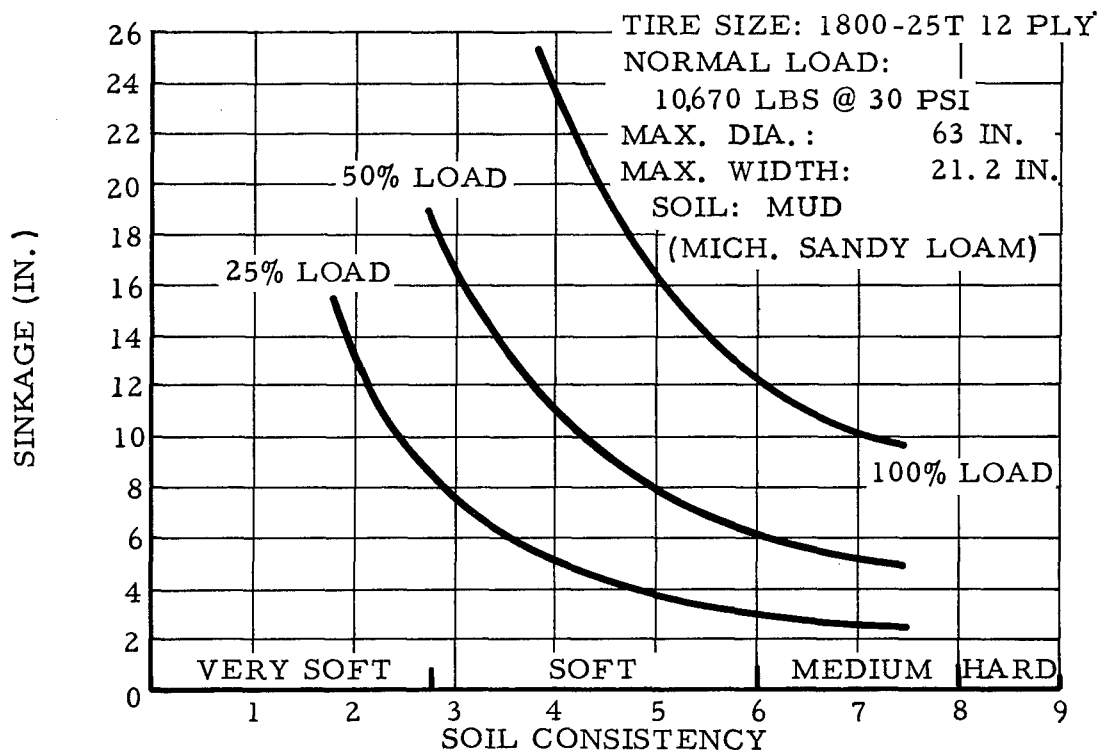


FIGURE B62. SINKAGE VS. SOIL CONSISTENCY, 18.00-25T, 12 PLY TIRE

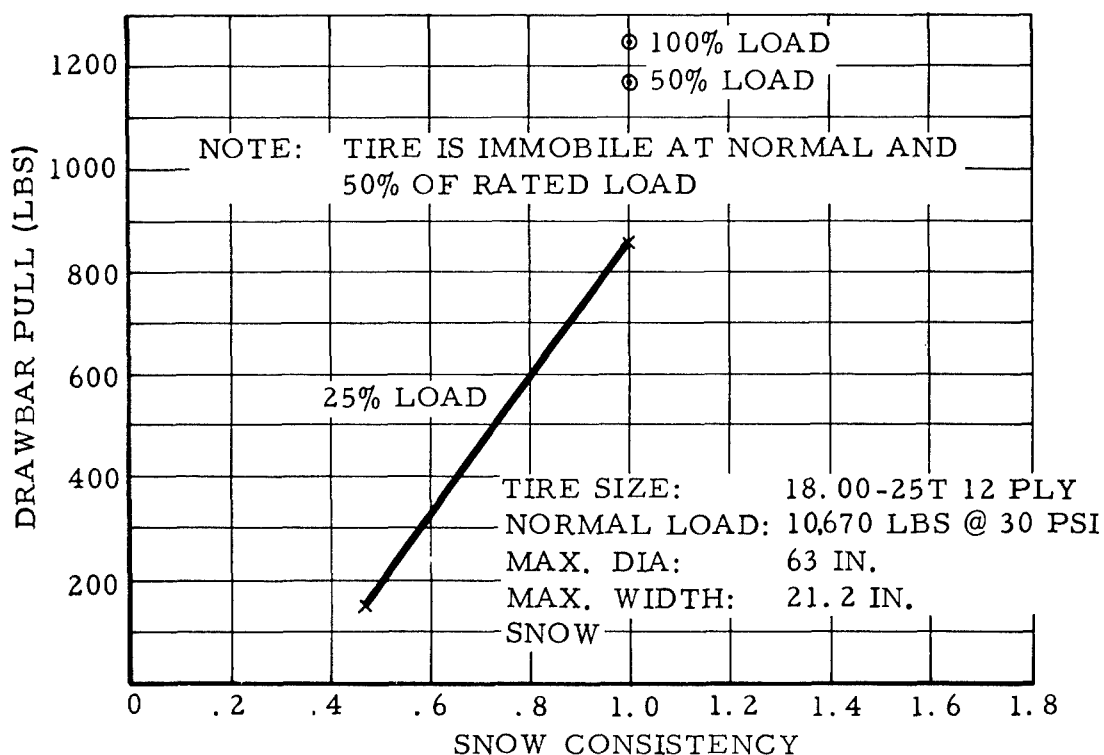


FIGURE B63. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-25T, 12 PLY TIRE

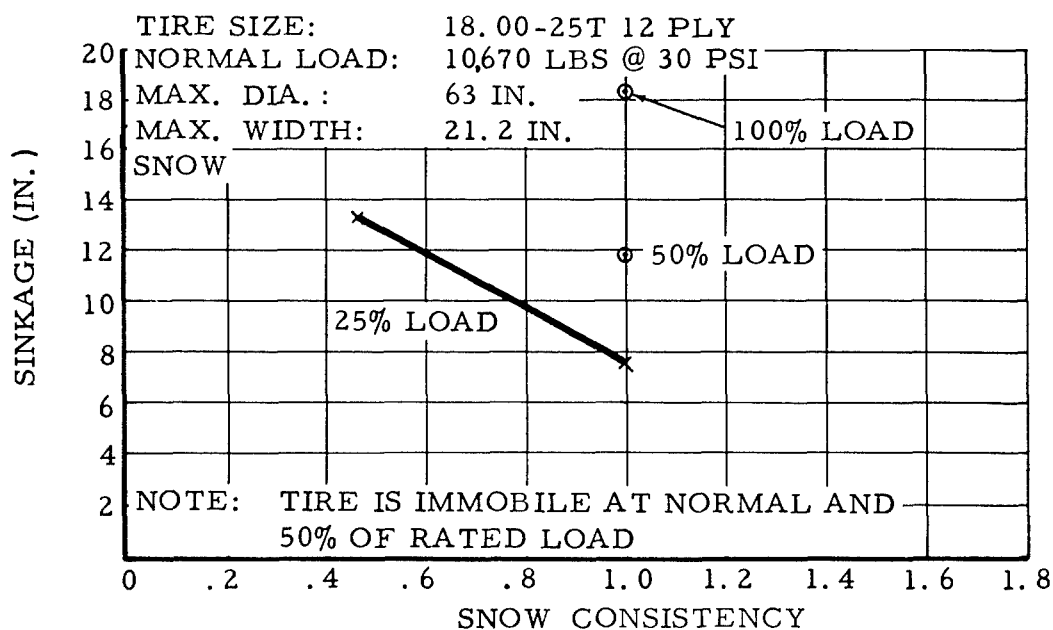


FIGURE B64. SINKAGE VS. SNOW CONSISTENCY, 18.00-25T, 12 PLY TIRE

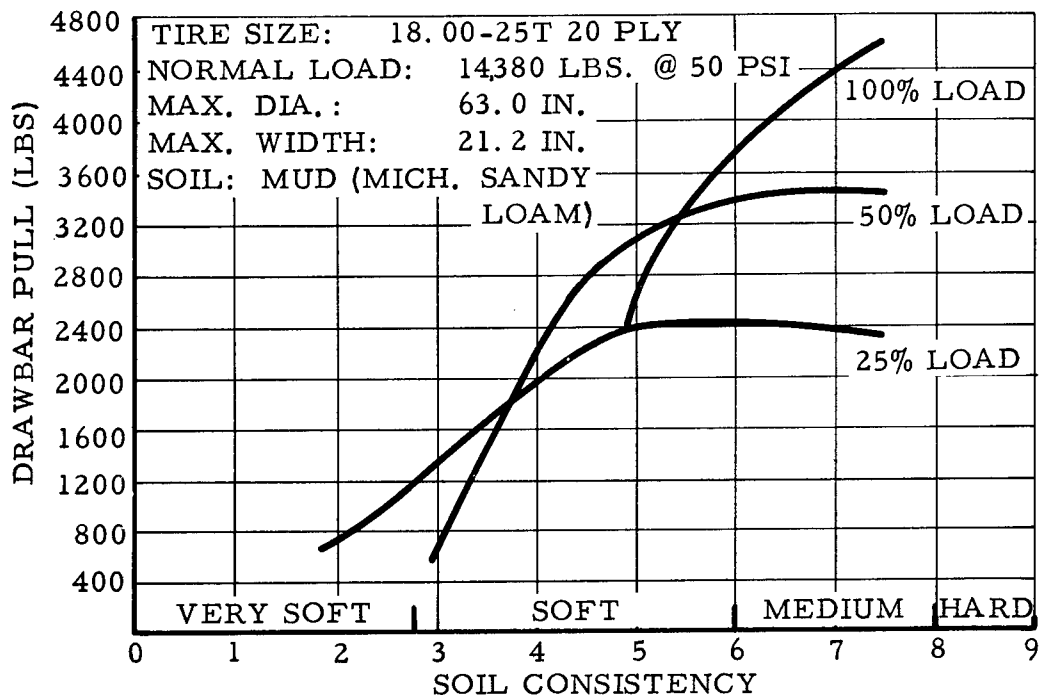


FIGURE B65. DRAWBAR PULL VS. SOIL CONSISTENCY, 1800-25T, 20 PLY TIRE

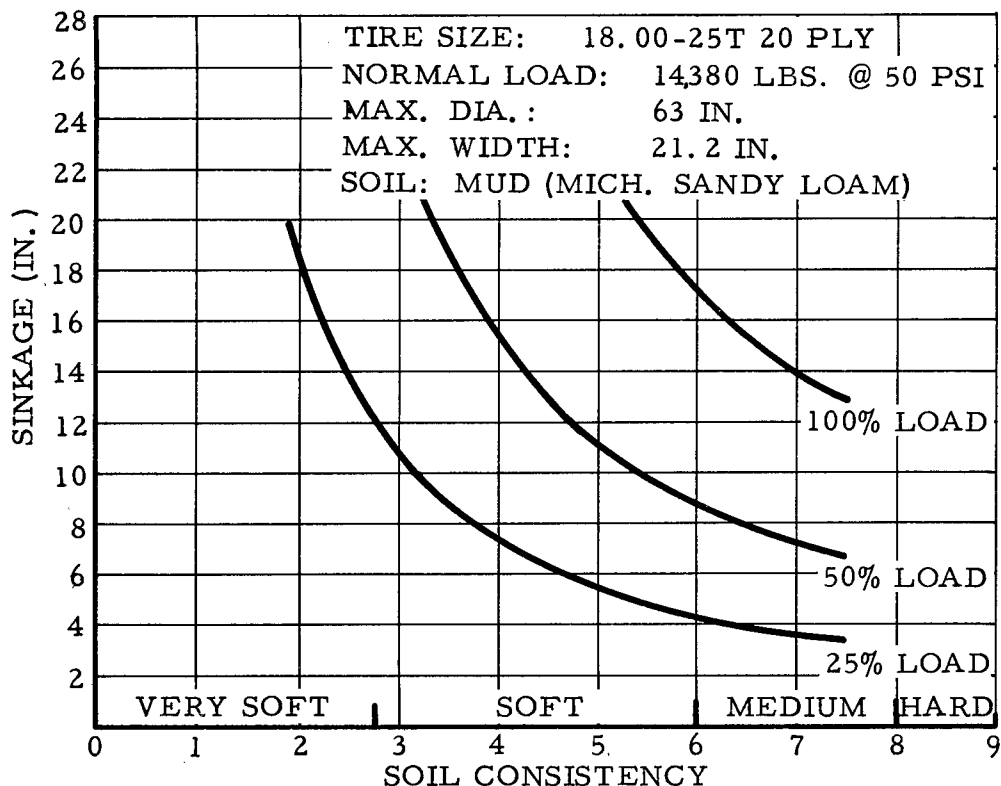


FIGURE B66. SINKAGE VS. SOIL CONSISTENCY, 18.00-25T, 20 PLY TIRE

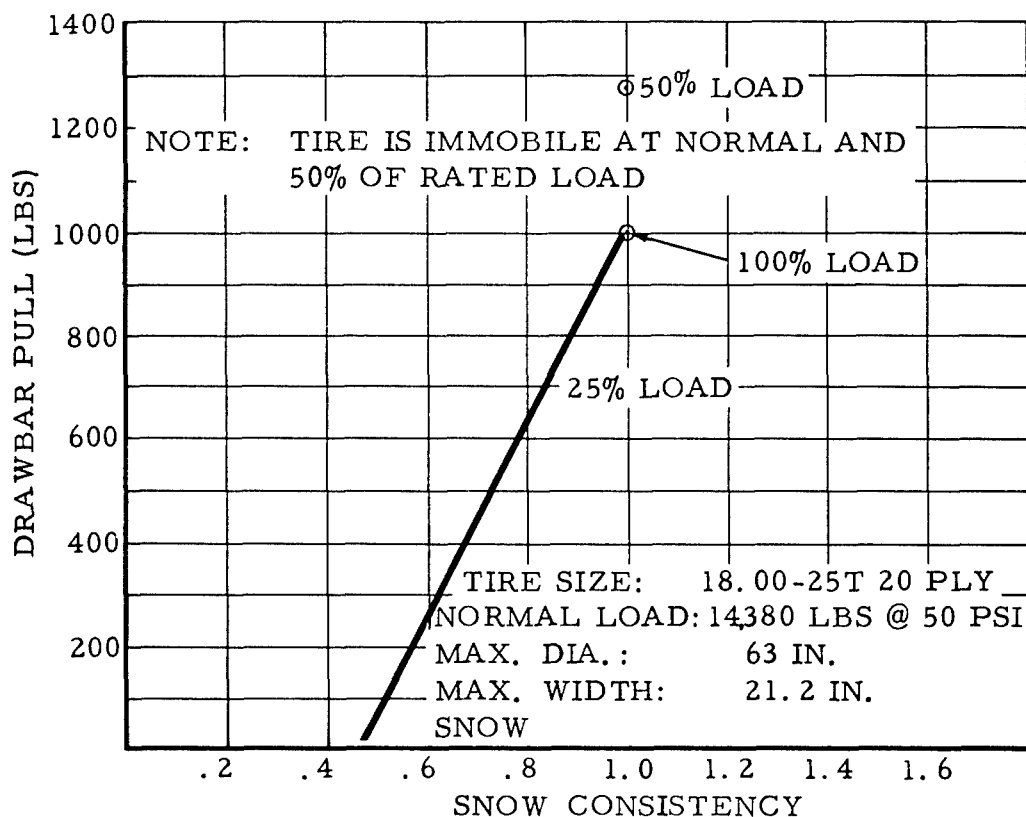


FIGURE B67. DRAWBAR PULL VS. SNOW CONSISTENCY, 18.00-25T, 20 PLY TIRE

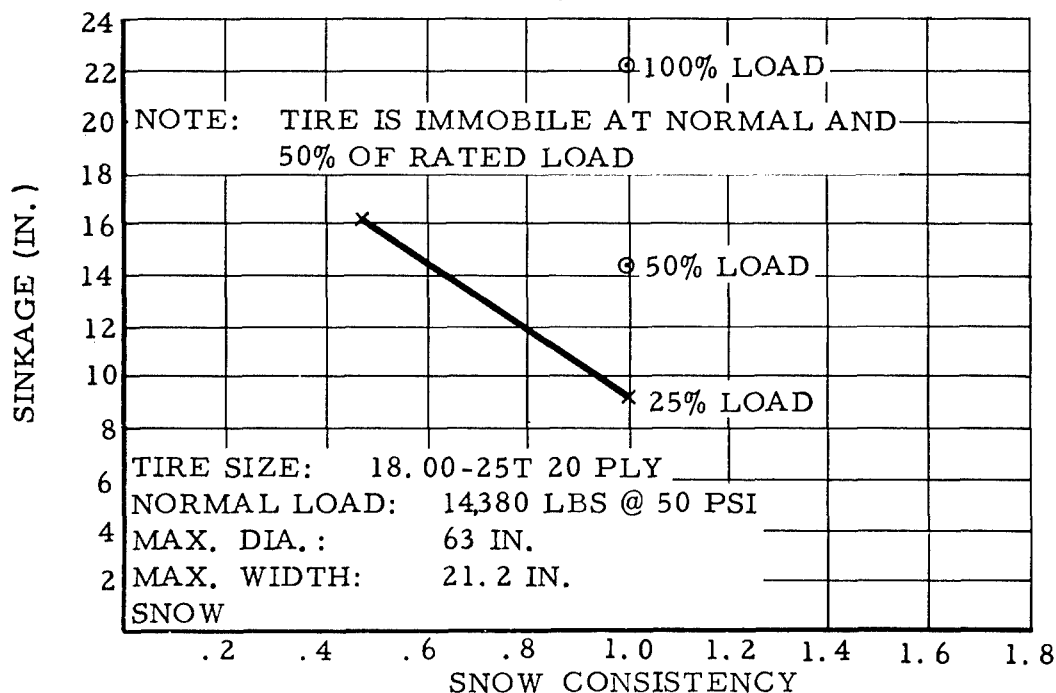


FIGURE B68. SINKAGE VS. SNOW CONSISTENCY, 18.00-25T, 20 PLY TIRE

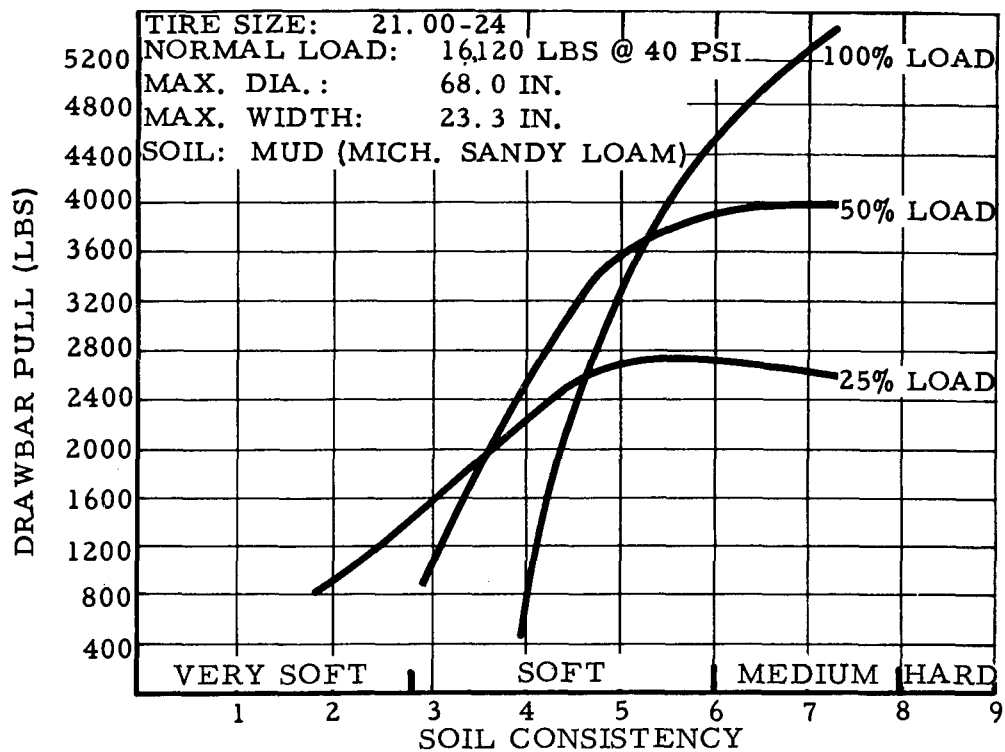


FIGURE B69. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-24 TIRE

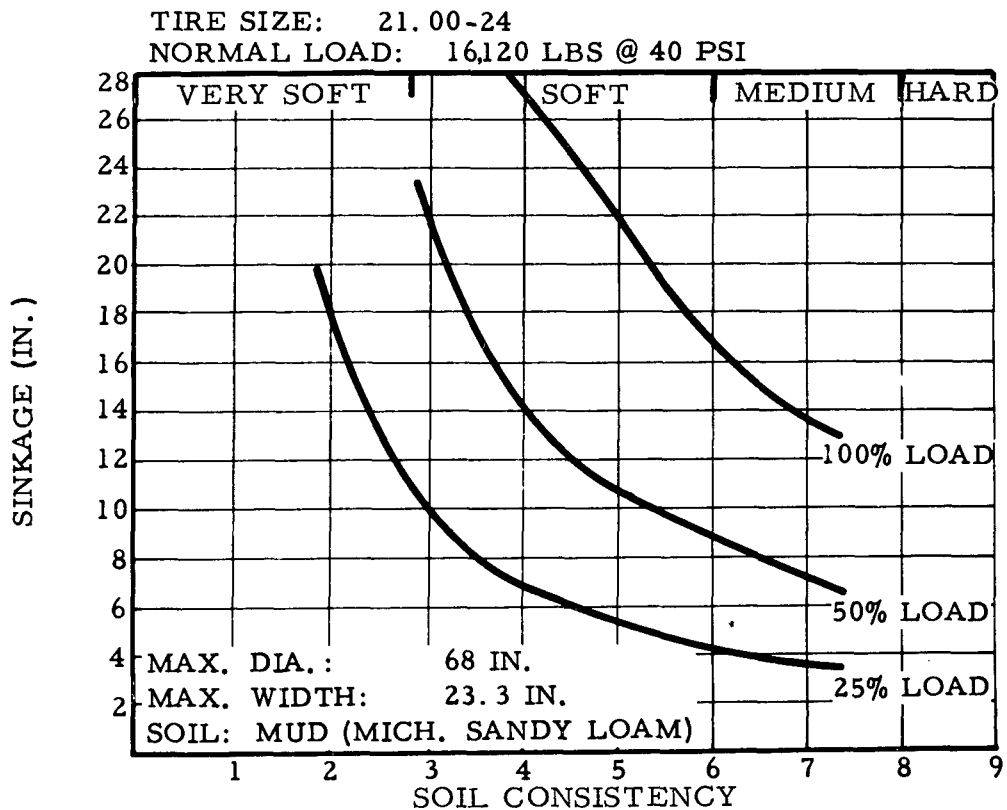


FIGURE B70. SINKAGE VS. SOIL CONSISTENCY, 21.00-24 TIRE

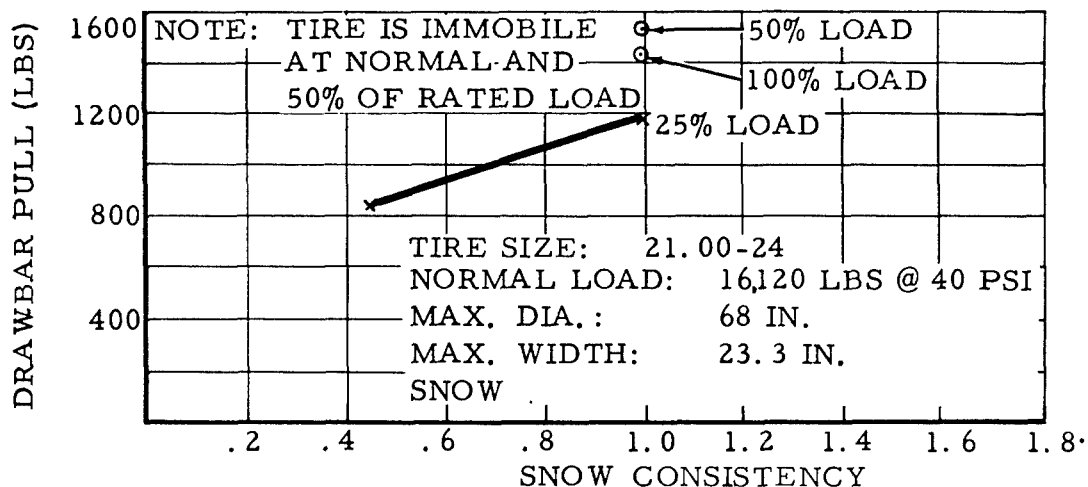


FIGURE B71. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-24 TIRE

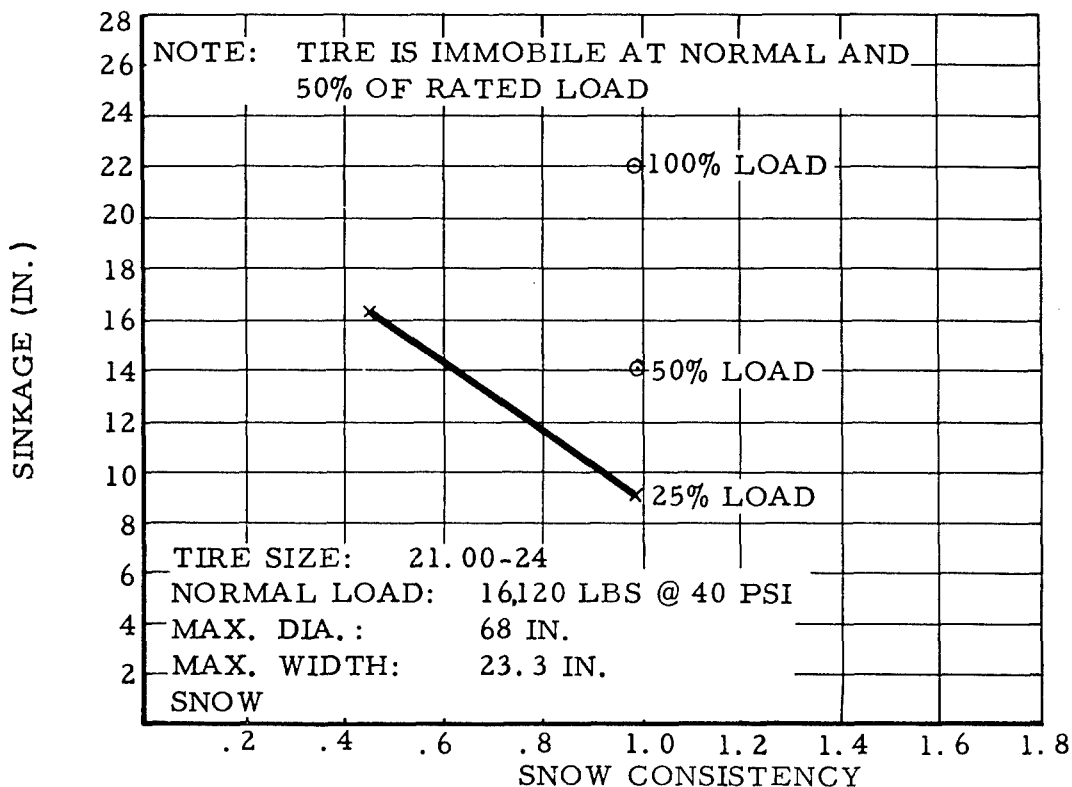


FIGURE B72. SINKAGE VS. SNOW CONSISTENCY, 21.00-24 TIRE

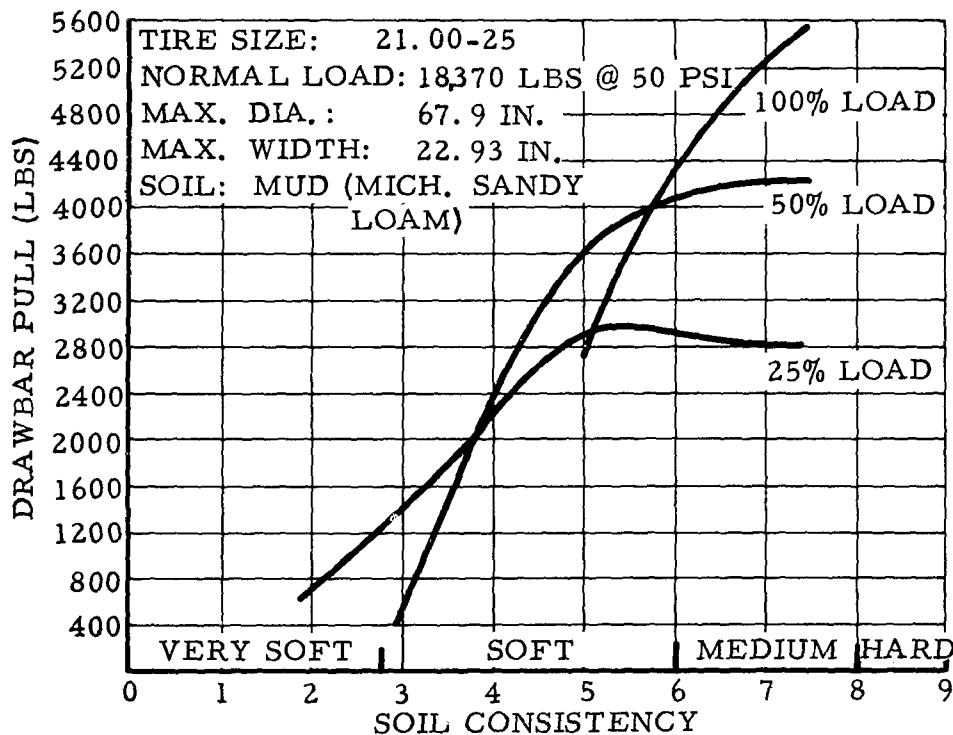


FIGURE B73. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-25 TIRE

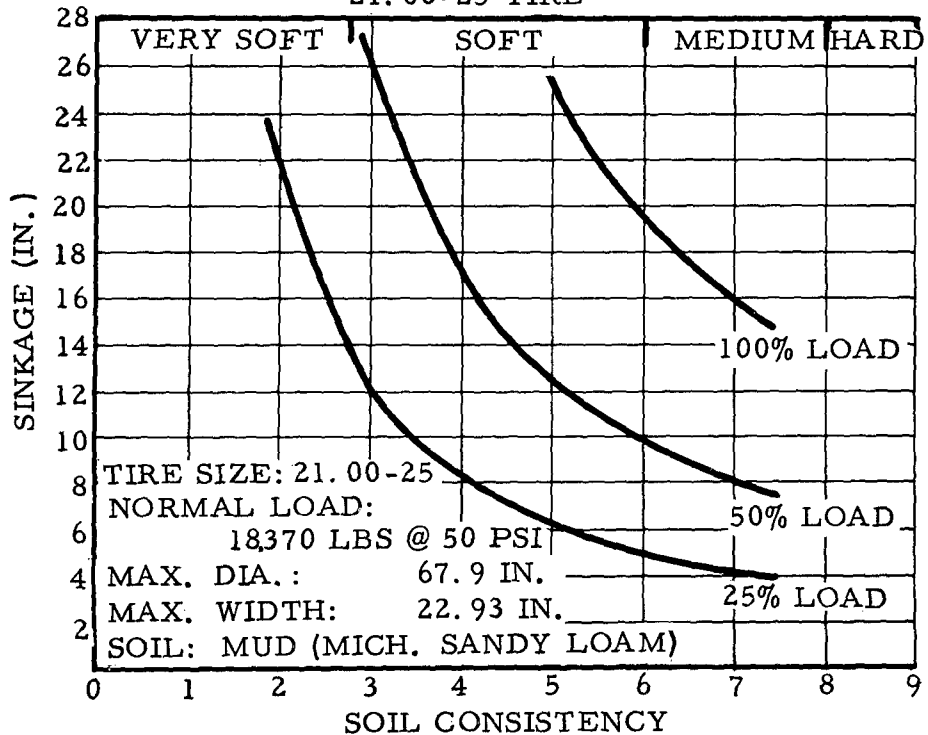


FIGURE B74. SINKAGE VS. SOIL CONSISTENCY, 21.00-25 TIRE

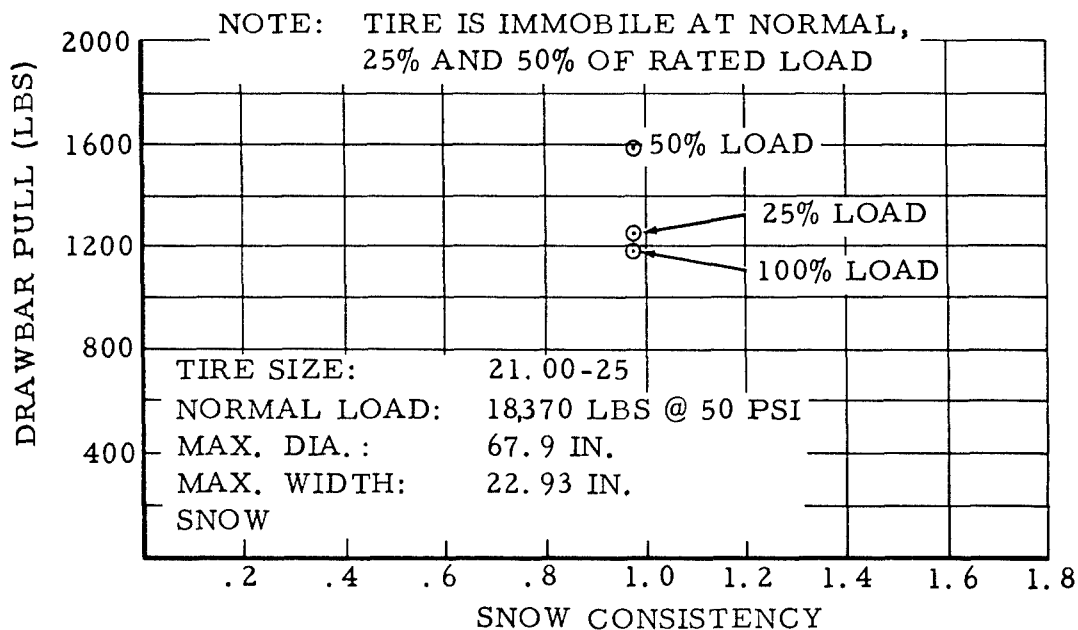


FIGURE B75. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-25 TIRE

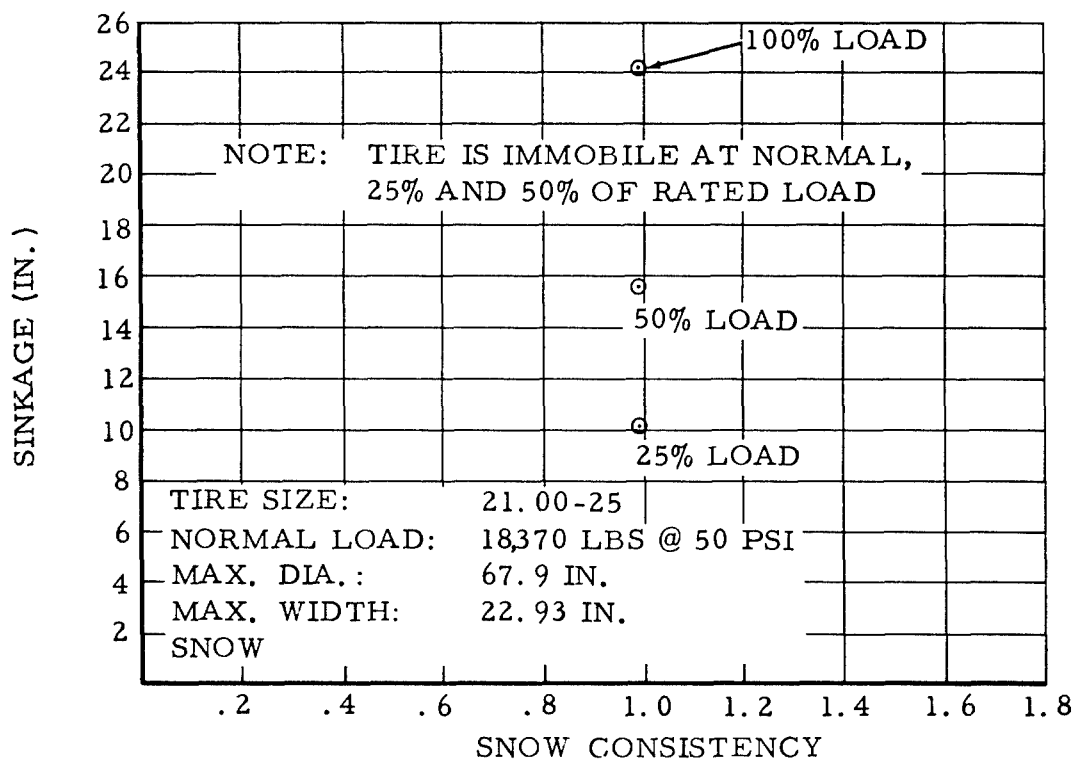


FIGURE B76. SINKAGE VS. SNOW CONSISTENCY, 21.00-25 TIRE

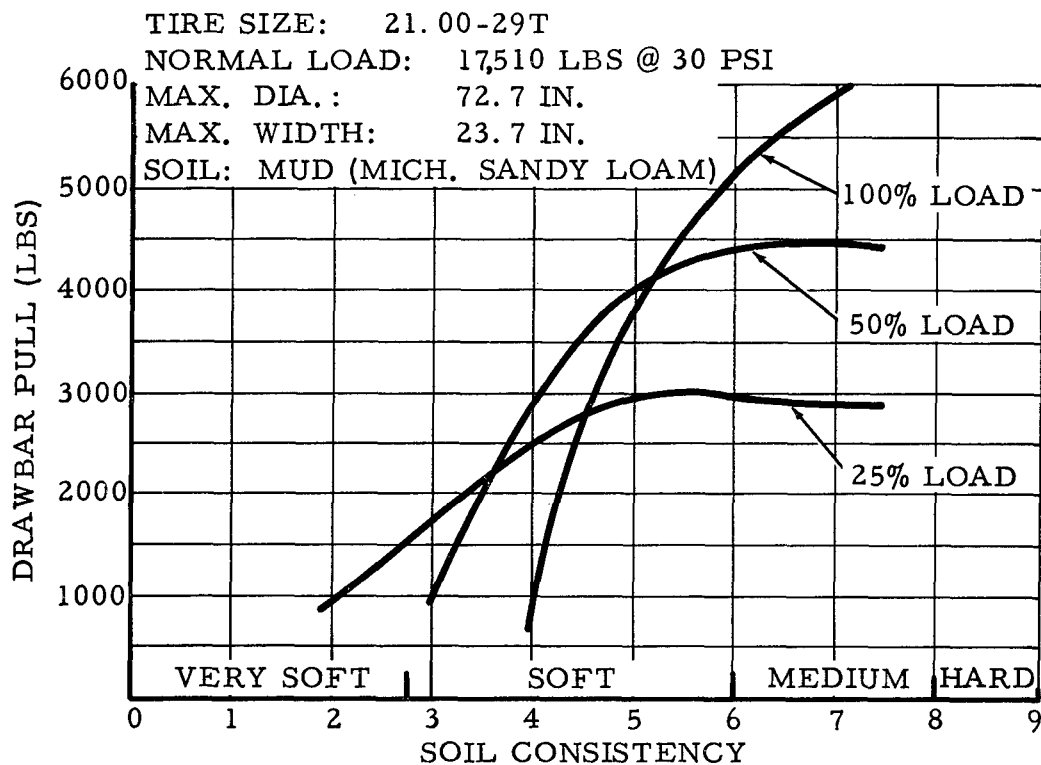


FIGURE B77. DRAWBAR PULL VS. SOIL CONSISTENCY, 21.00-29T TIRE

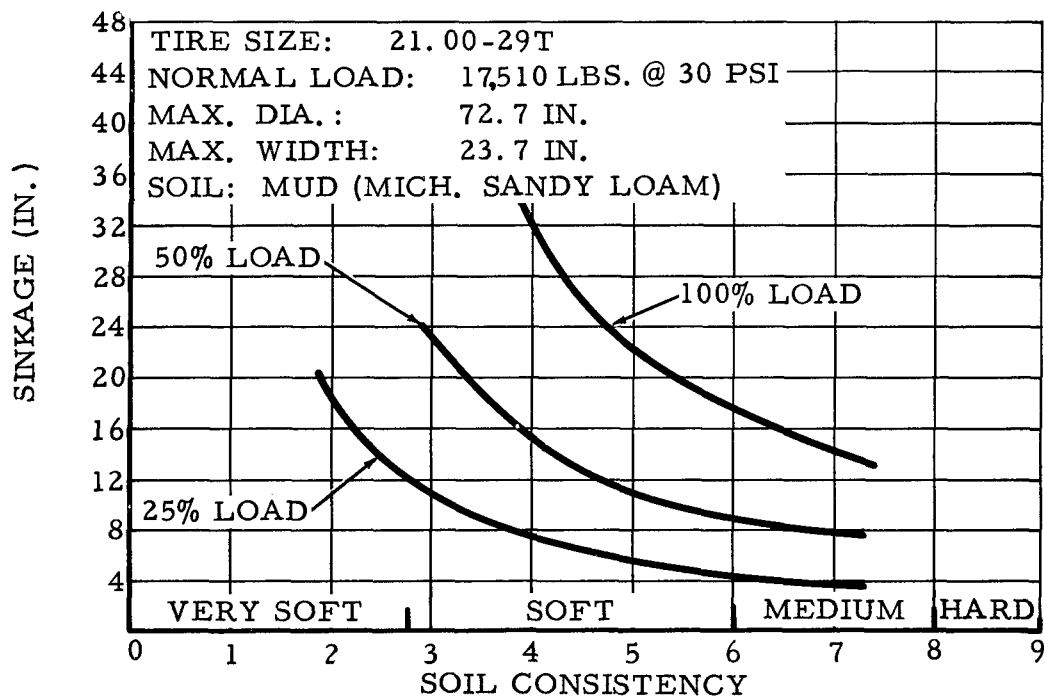


FIGURE B78. SINKAGE VS. SOIL CONSISTENCY, 21.00-29T TIRE

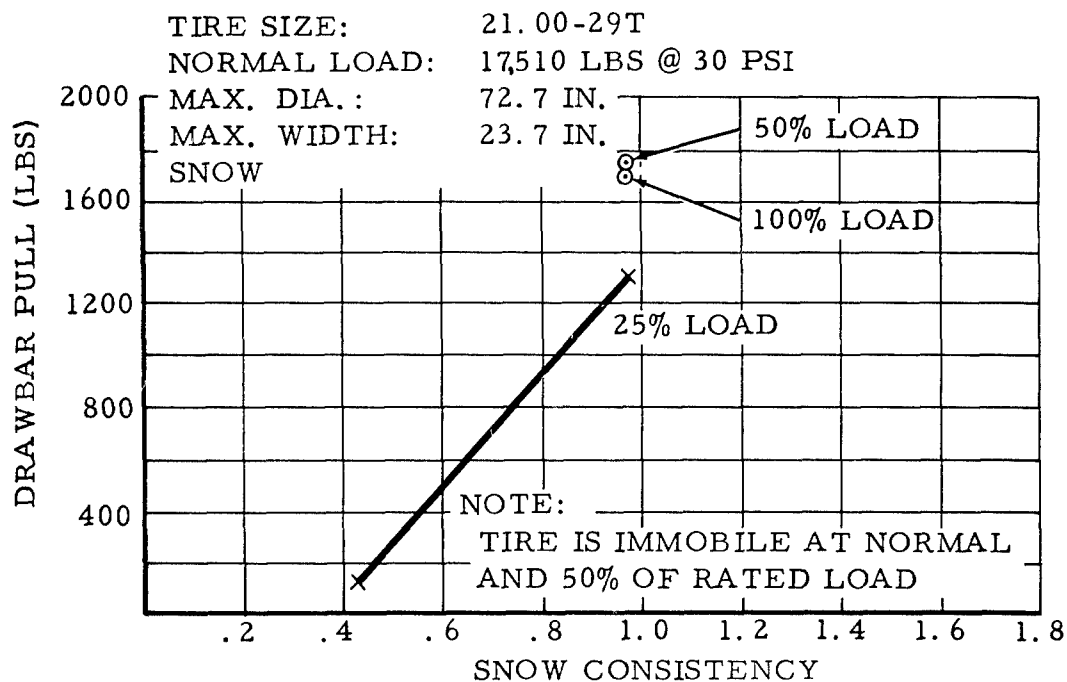


FIGURE B79. DRAWBAR PULL VS. SNOW CONSISTENCY, 21.00-29T TIRE

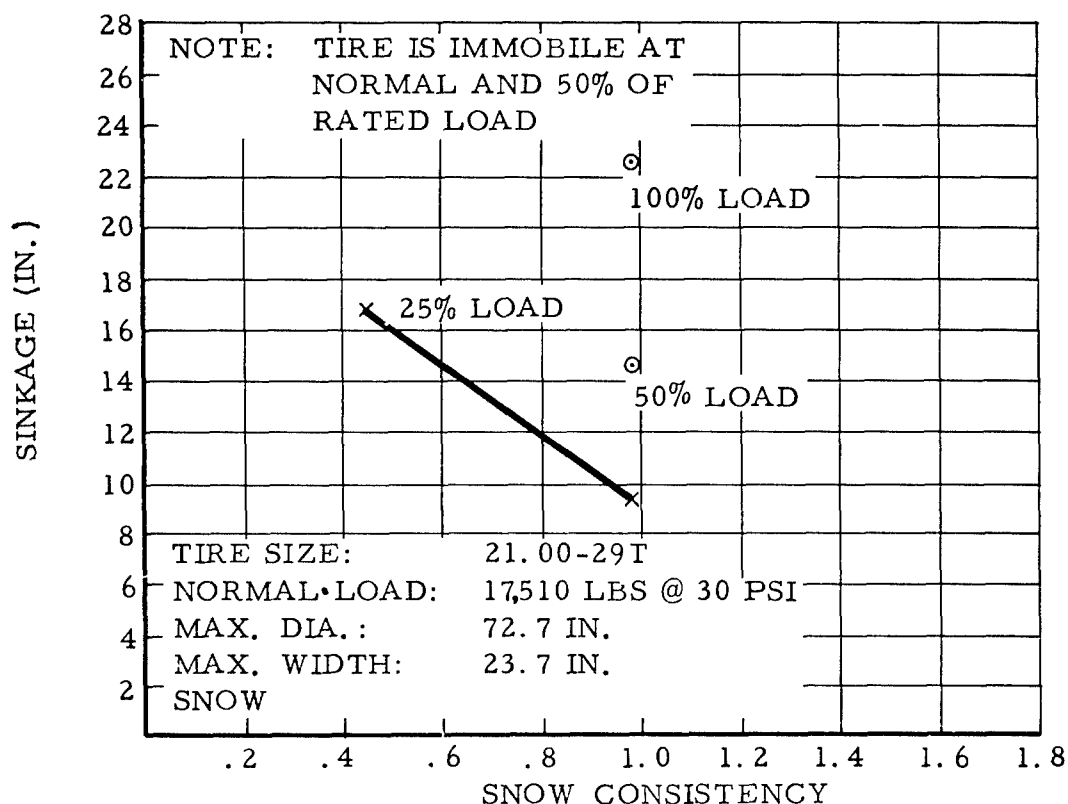


FIGURE B80. SINKAGE VS. SNOW CONSISTENCY, 21.00-29T TIRE

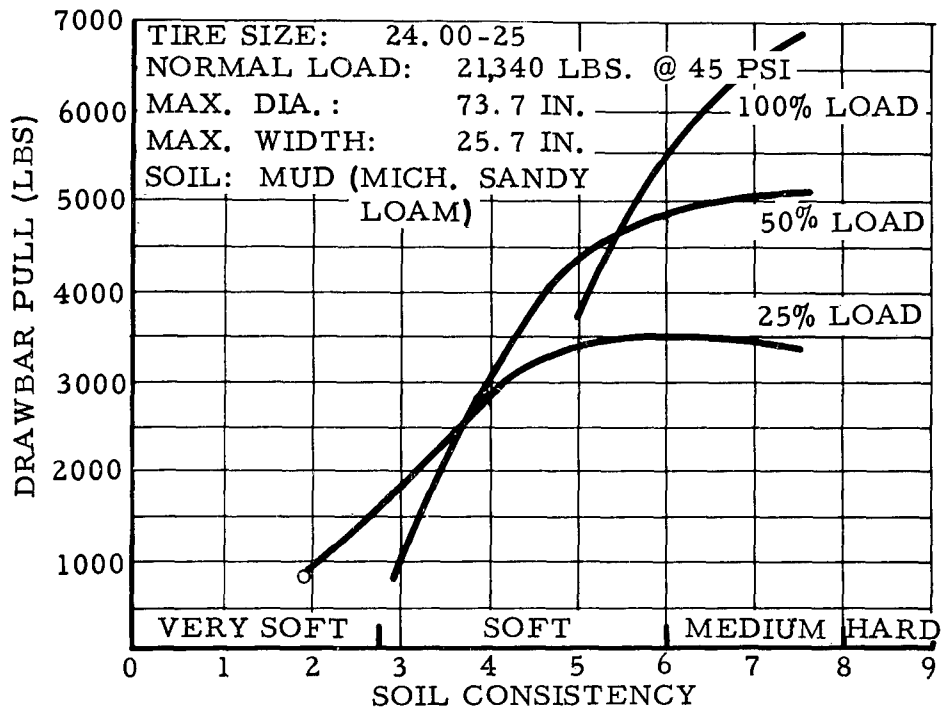


FIGURE B81. DRAWBAR PULL VS. SOIL CONSISTENCY, 24.00-25 TIRE

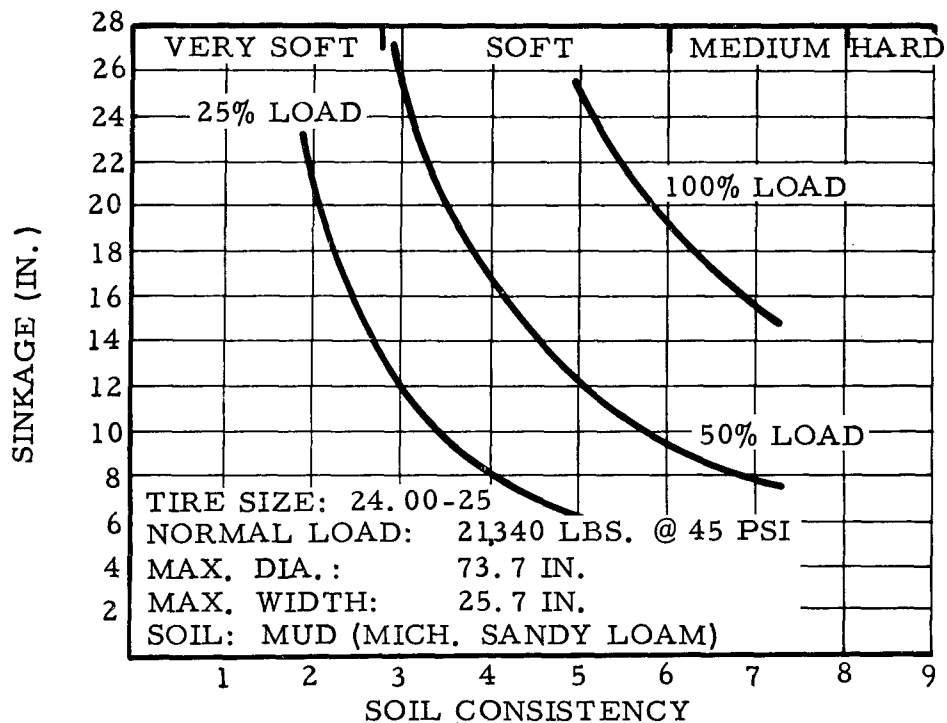


FIGURE B82. SINKAGE VS. SOIL CONSISTENCY, 24.00-25 TIRE

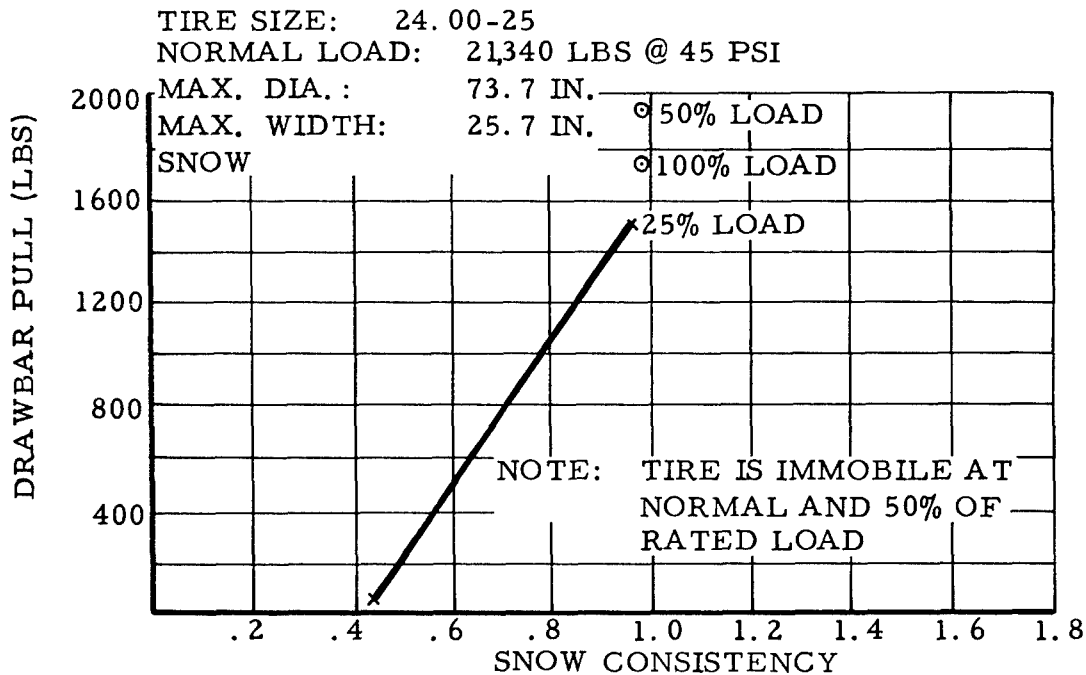


FIGURE B83. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-25 TIRE

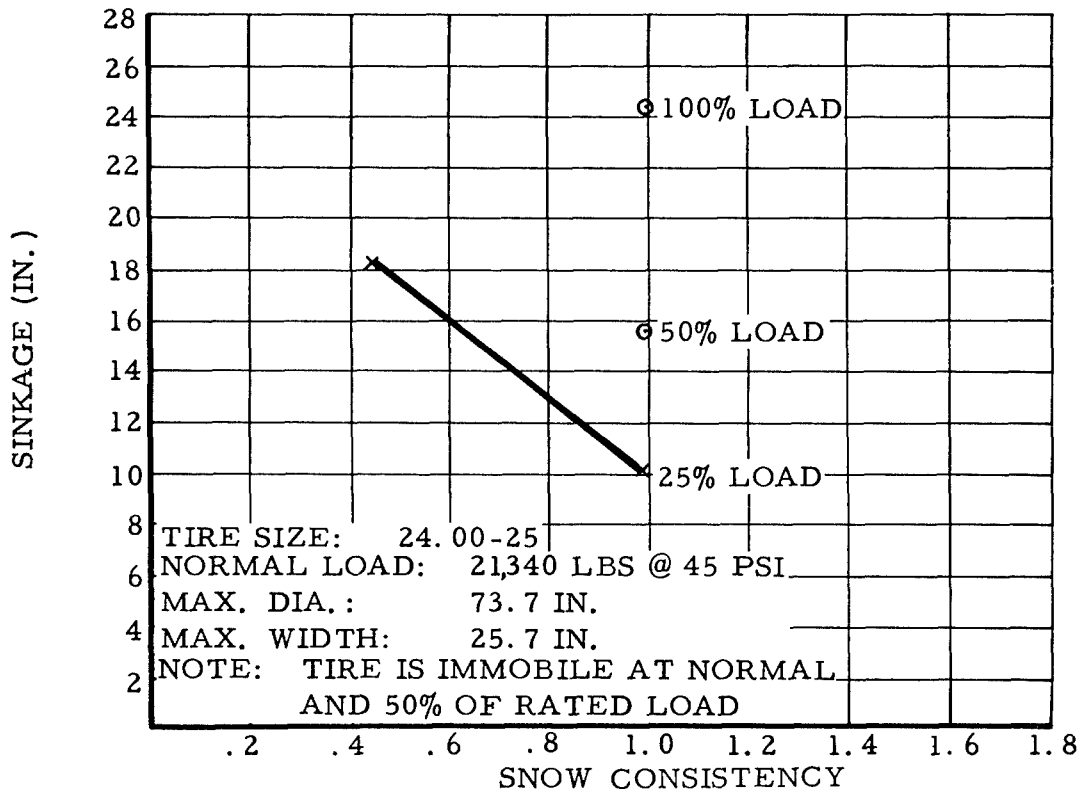


FIGURE B84. SINKAGE VS. SNOW CONSISTENCY, 24.00-25 TIRE

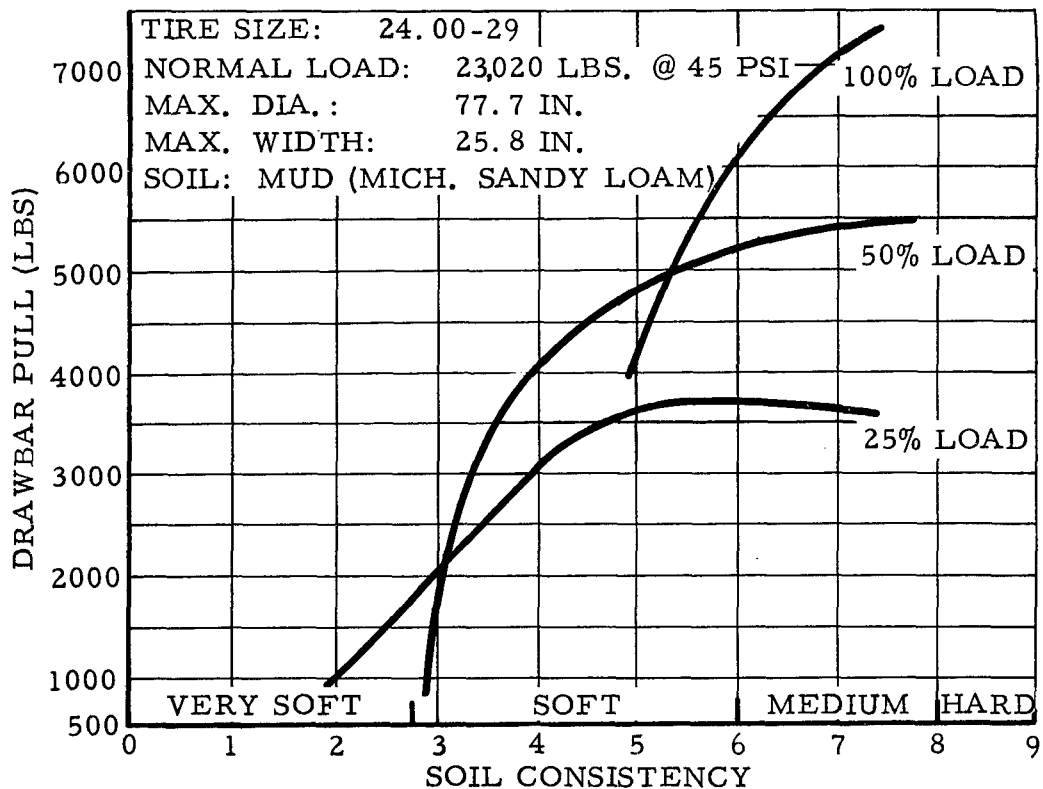


FIGURE B85. DRAWBAR PULL VS. SOIL CONSISTENCY, 24.00-29 TIRE

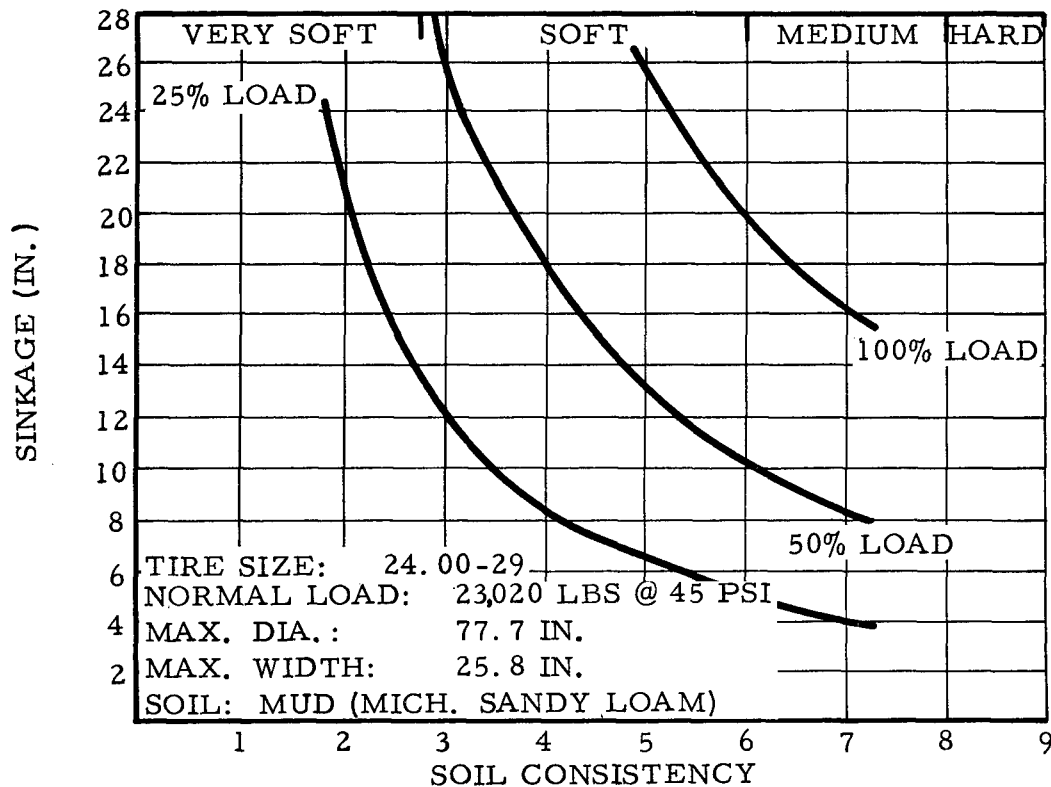


FIGURE B86. SINKAGE VS. SOIL CONSISTENCY, 24.00-29 TIRE

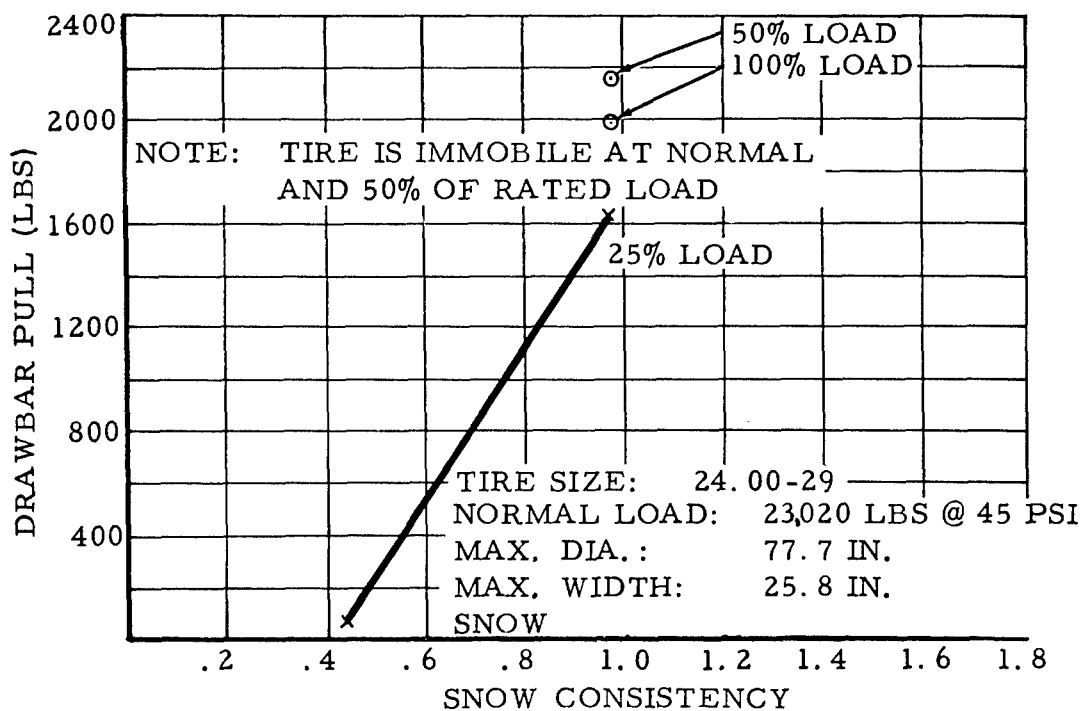


FIGURE B87. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-29 TIRE

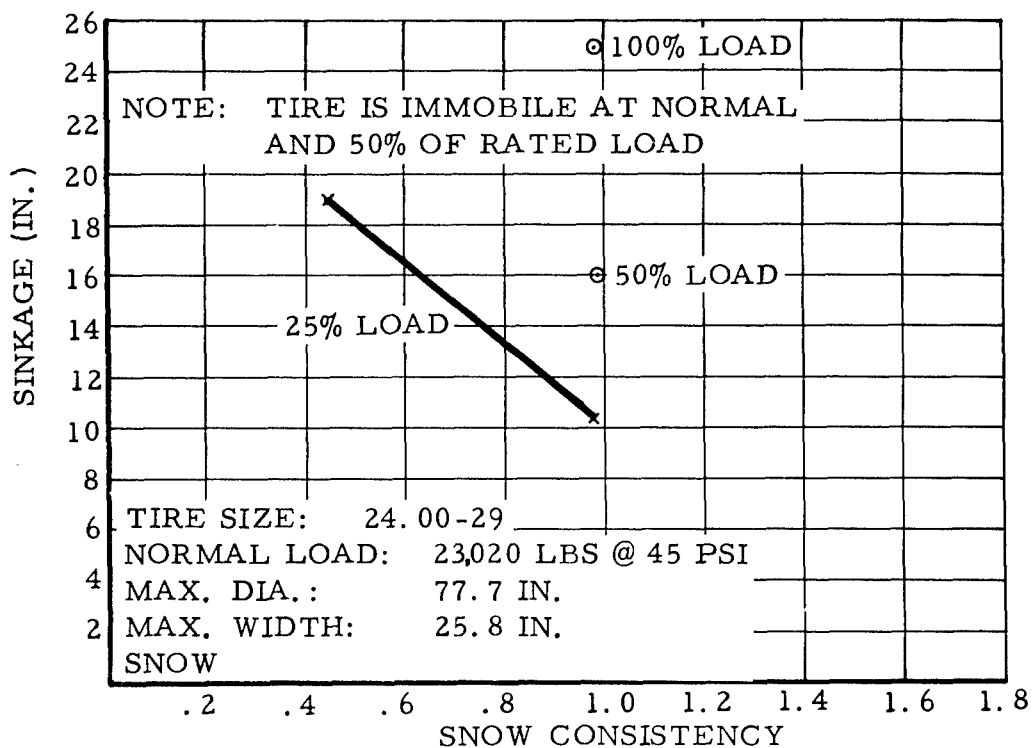


FIGURE B88. SINKAGE VS. SNOW CONSISTENCY, 24.00-29 TIRE

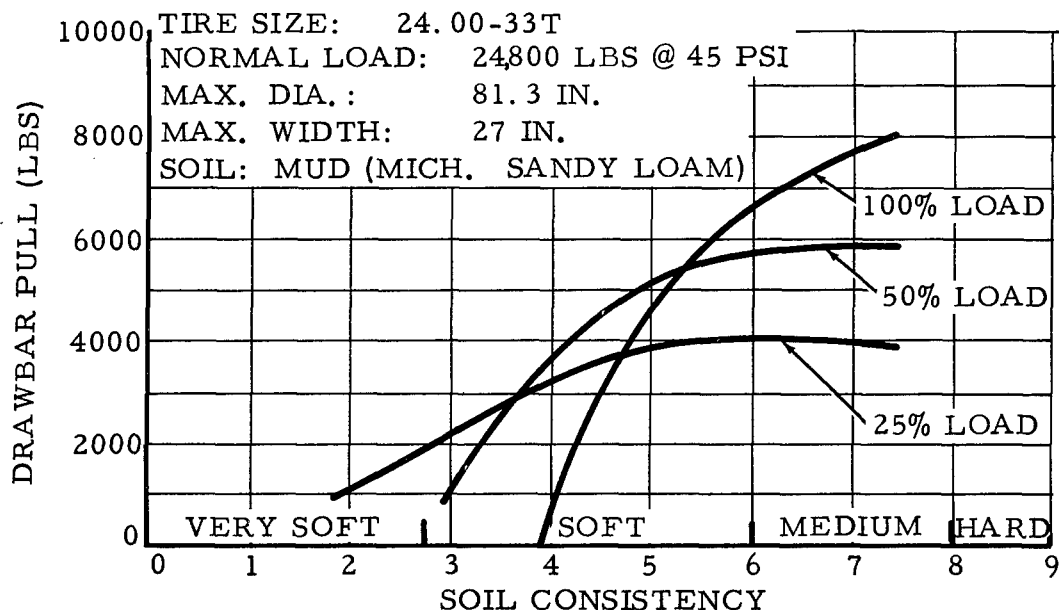


FIGURE 89. DRAWBAR PULL VS. SOIL CONSISTENCY,
 24.00-33T TIRE

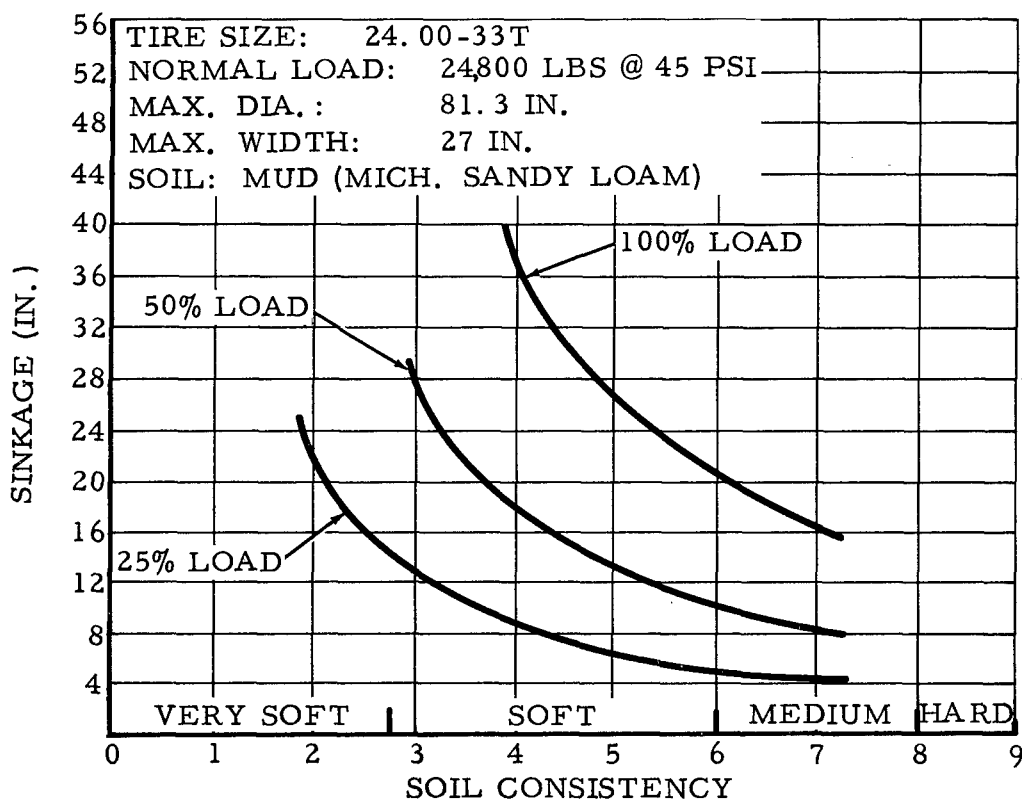


FIGURE B90. SINKAGE VS. SOIL CONSISTENCY,
 24.00-33T TIRE

TIRE SIZE: 24.00-33T
 NORMAL LOAD: 24800 LBS @ 45 PSI
 MAX. DIA.: 81.3 IN.
 MAX. WIDTH: 27.0 IN.
 SNOW

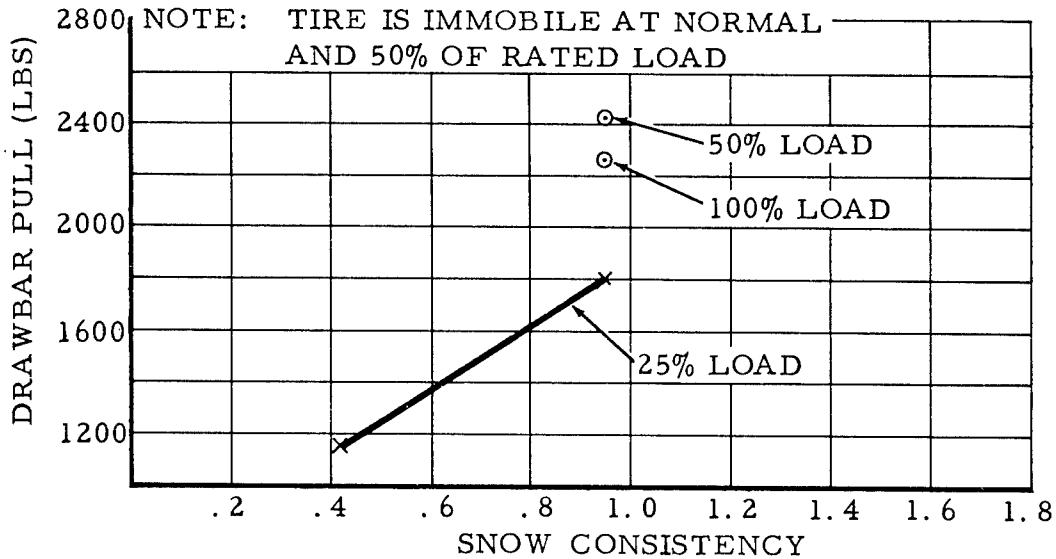


FIGURE B91. DRAWBAR PULL VS. SNOW CONSISTENCY, 24.00-33T TIRE

TIRE SIZE: 24.00-33T
 NORMAL LOAD: 24800 LBS @ 45 PSI.
 MAX. DIA.: 81.3 IN.
 MAX. WIDTH: 27 IN.
 SNOW

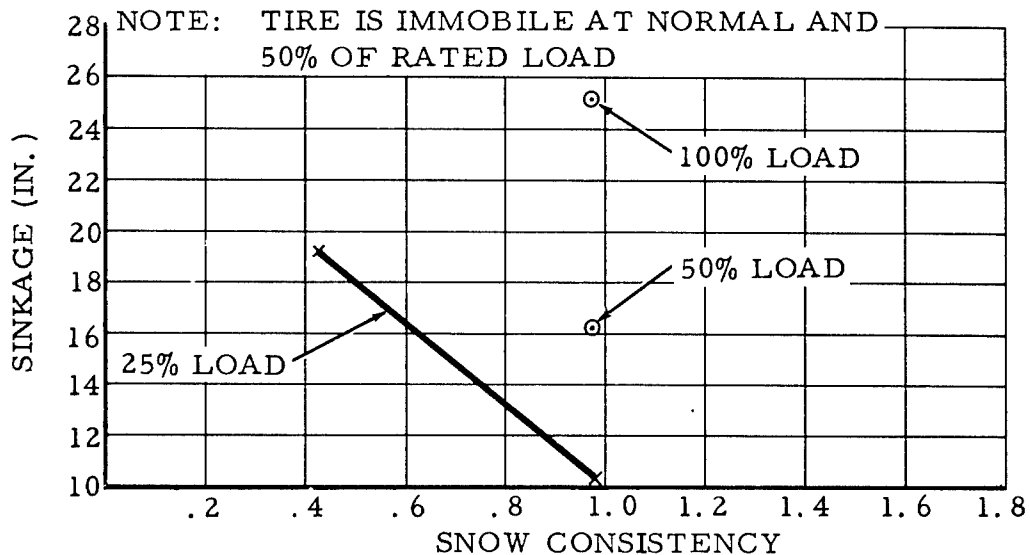


FIGURE B92. SINKAGE VS. SNOW CONSISTENCY, 24.00-33T TIRE

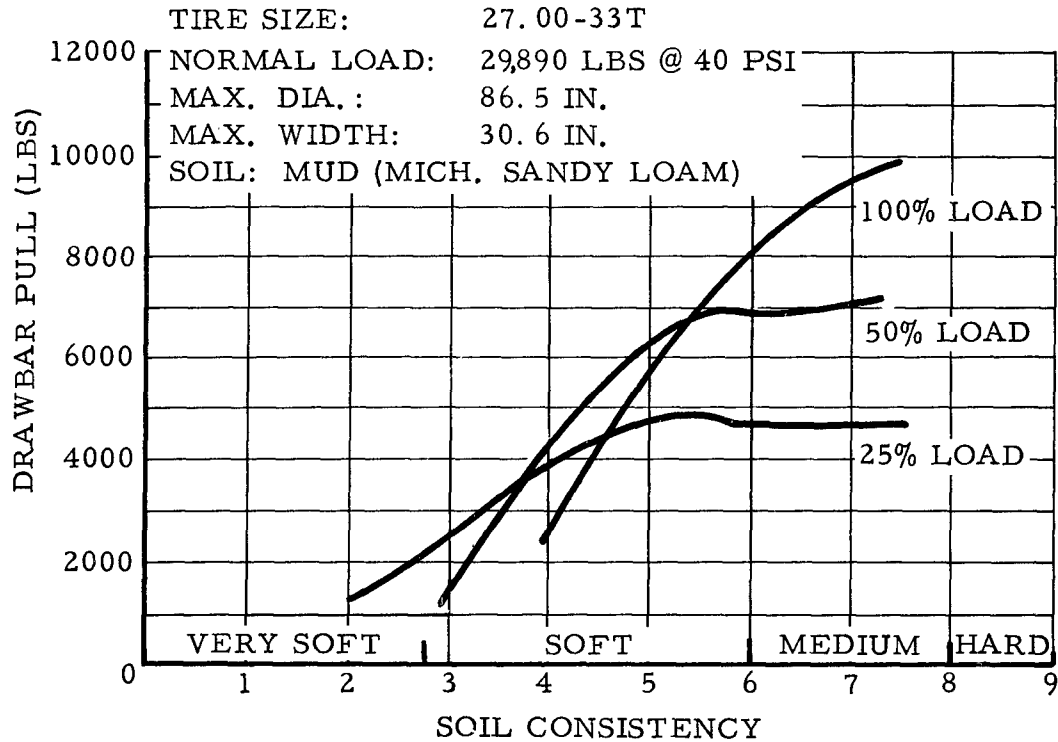


FIGURE B93. DRAWBAR PULL VS. SOIL CONSISTENCY, 27.00-33T TIRE

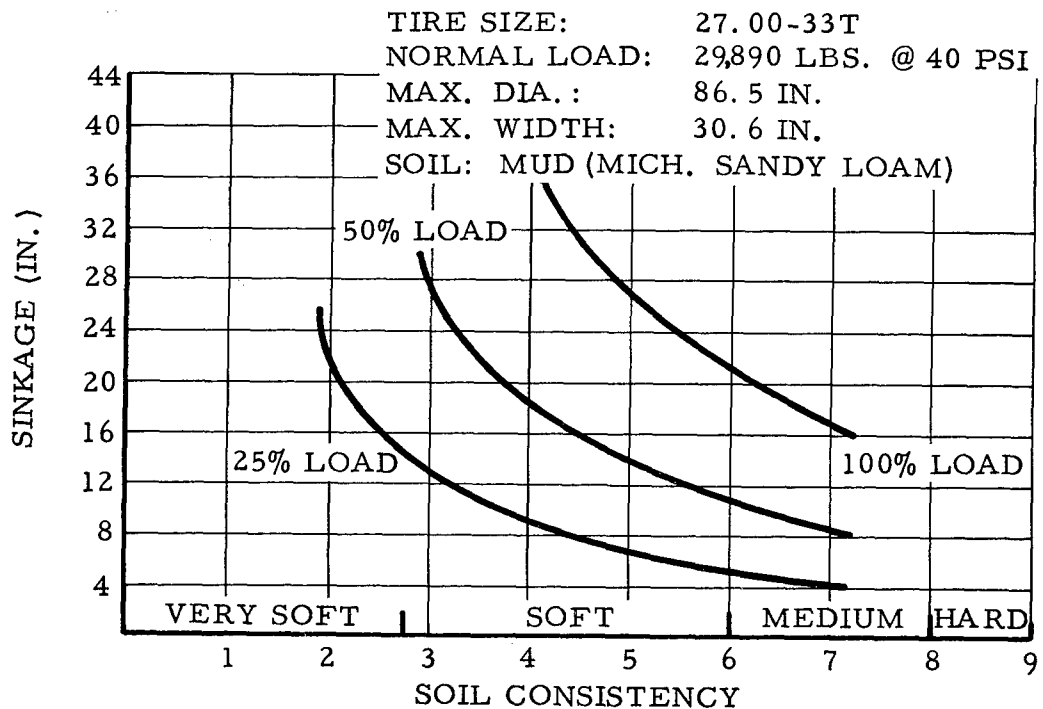


FIGURE B94. SINKAGE VS. SOIL CONSISTENCY, 27.00-33T TIRE

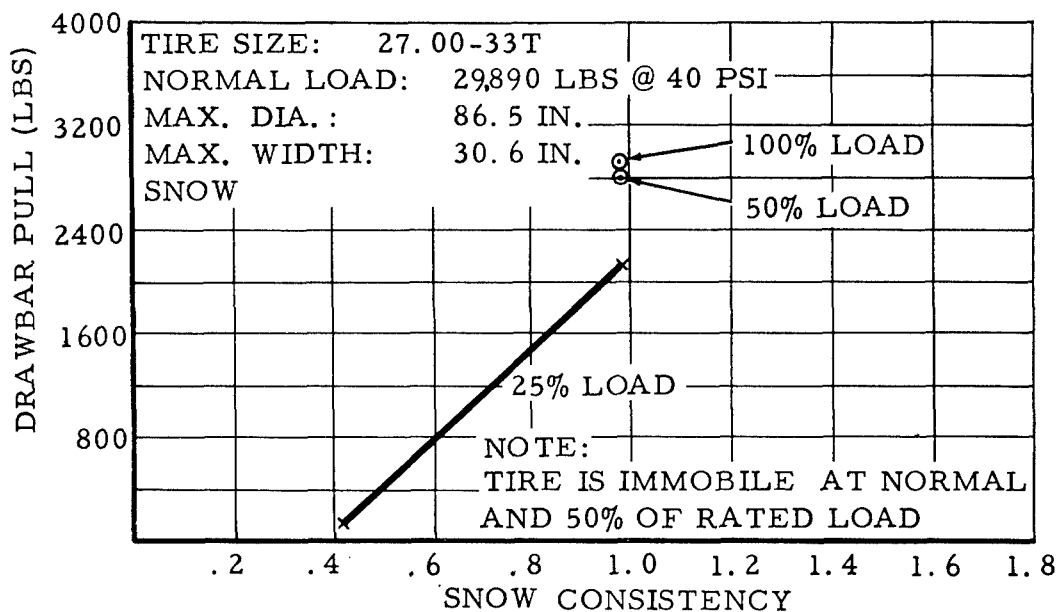


FIGURE B95. DRAWBAR PULL VS. SNOW CONSISTENCY, 27.00-33T TIRE

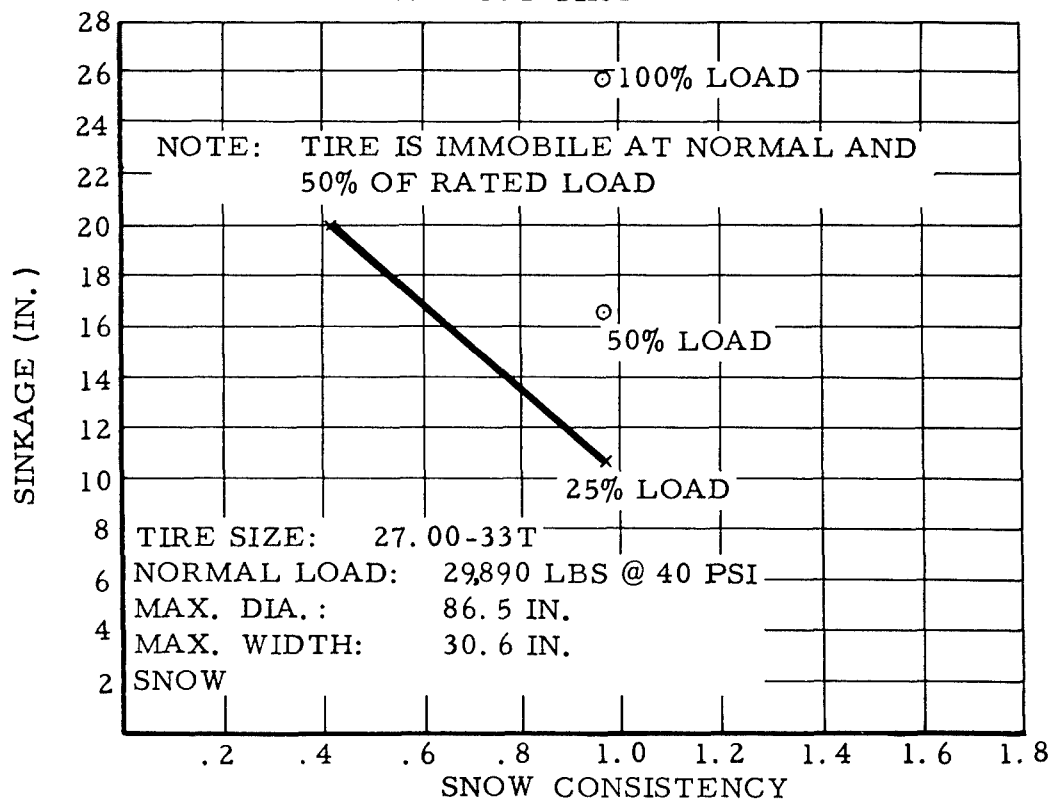


FIGURE B96. SINKAGE VS. SNOW CONSISTENCY, 27.00-33T TIRE

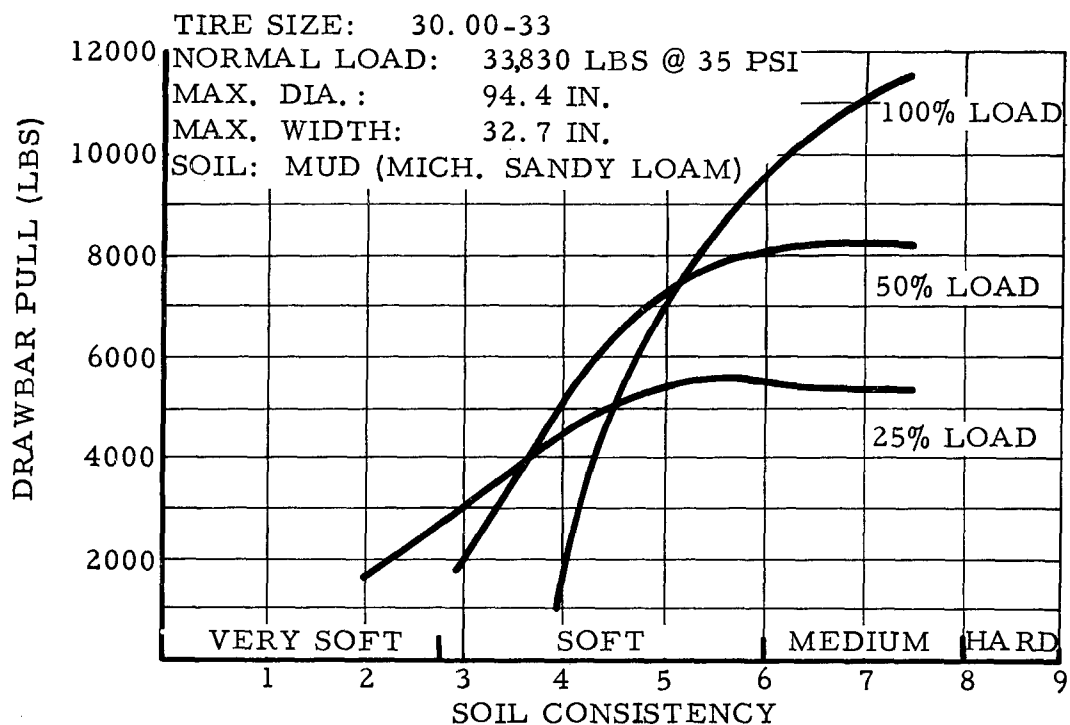


FIGURE B97. DRAWBAR PULL VS. SOIL CONSISTENCY, 30.00-33 TIRE

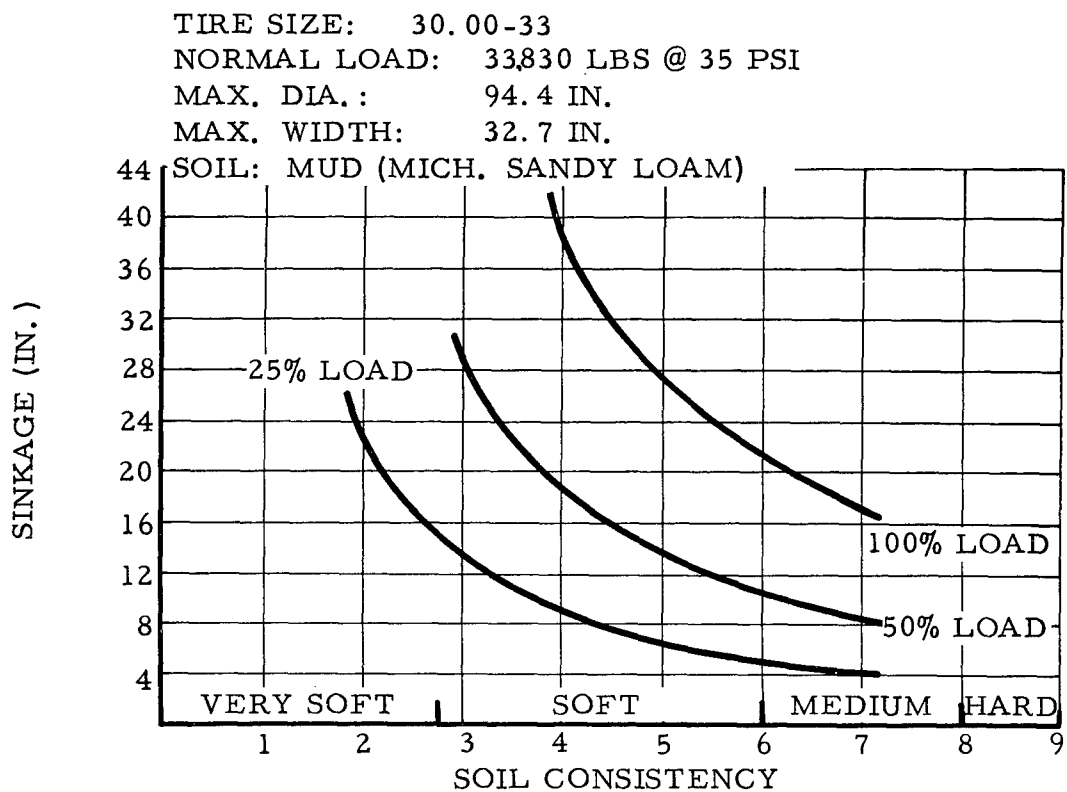


FIGURE B98. SINKAGE VS. SOIL CONSISTENCY, 30.00-33 TIRE

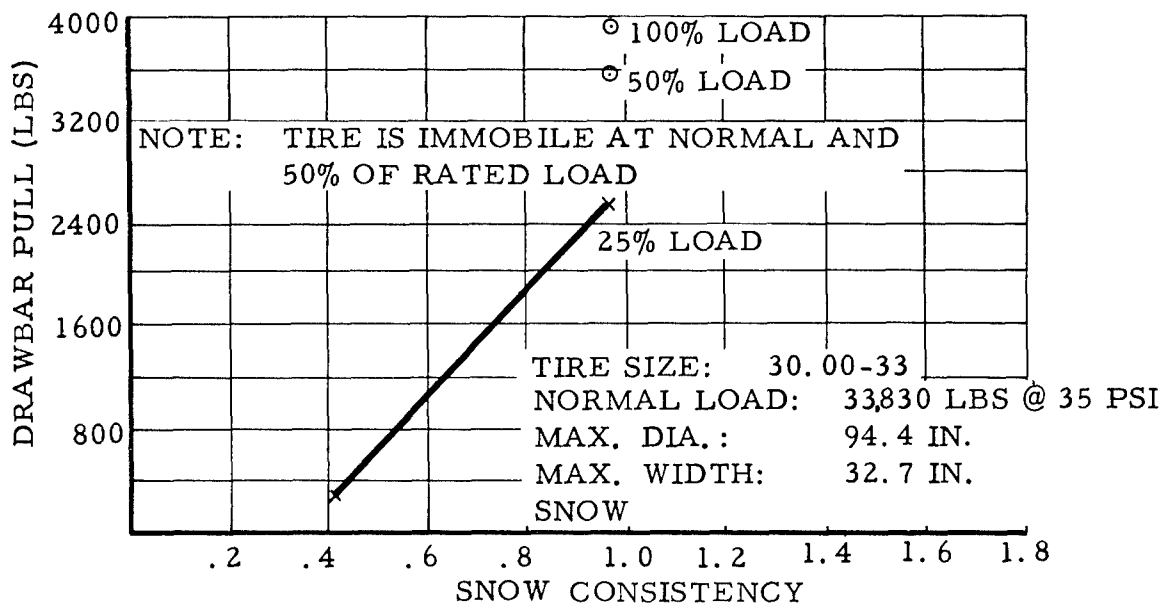


FIGURE B99. DRAWBAR PULL VS. SNOW CONSISTENCY, 30.00-33 TIRE

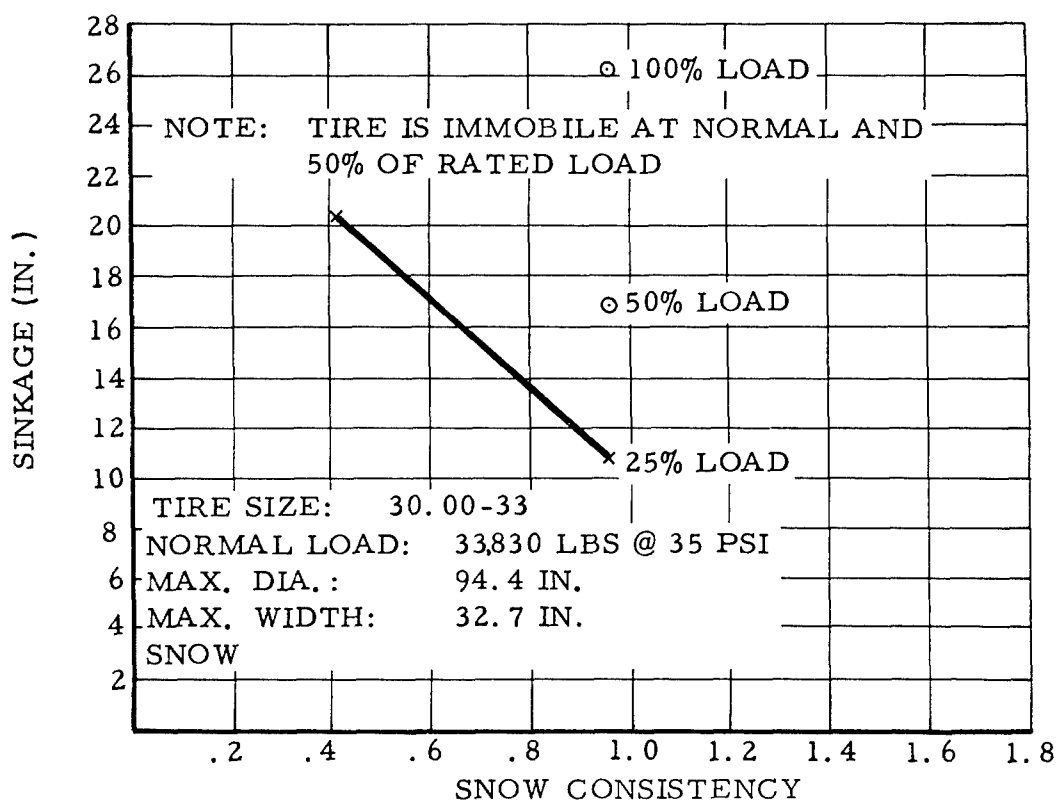


FIGURE B100. SINKAGE VS. SNOW CONSISTENCY, 30.00-33 TIRE

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<p>AD <u> </u> ACCESSION NO <u> </u> Ordnance Tank-Automotive Command, Detroit Arsenal, Computer Laboratory, Center Line, Michigan DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE MOBILITY COMPUTATION (U) - A. Edwards</p> <p>Report No. RR-7, February, 1960, 68pp - Illus - Tables Contract No. DA-20-089-ORD-39246, DA Proj. 5W72-01-001 ORD Proj. 5510.11.270 Unclassified Report</p> <p>A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.</p> <p>Curves of sinkage and drawbar pull versus mud and snow soil consistencies were plotted of various sized tires for preliminary design guidance.</p>	<p>-UNCLASSIFIED-</p> <p>1. DIGITAL COMPUTER</p> <p>2. Contract No. DA-20-089-ORD-39246</p>	<p>AD <u> </u> ACCESSION NO <u> </u> Ordnance Tank-Automotive Command, Detroit Arsenal, Computer Laboratory, Center Line, Michigan DIGITAL COMPUTER PROGRAM FOR WHEELED VEHICLE MOBILITY COMPUTATION (U) - A. Edwards</p> <p>Report No. RR-7, February, 1960, 68pp - Illus - Tables Contract No. DA-20-089-ORD-39246, DA Proj. 5W72-01-001 ORD Proj. 5510.11.270 Unclassified Report</p> <p>A general computer program was written for the Electrodata 204 Digital Computer to permit rapid solution of wheeled vehicle mobility performance in accordance with the theory and procedure practiced by OTAC Land Locomotion Laboratory.</p> <p>Curves of sinkage and drawbar pull versus mud and snow soil consistencies were plotted of various sized tires for preliminary design guidance.</p>	<p>-UNCLASSIFIED-</p> <p>1. DIGITAL COMPUTER</p> <p>2. Contract No. DA-20-089-ORD-39246</p>
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